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Research and Human Welfare

THE European war has forced many people, who formerly gave the subject little thought, to consider the importance of science in the promotion of human welfare. There are still a few people who contend that the war is a result of the scientific development of the past 50 years. These people insist that a votary of science of necessity becomes a believer in the doctrine of materialism. Such a view is plainly due to a confusion of ideas and is born of fear rather than of intelligence. Were such the correct interpretation of the causes of the calamity devastating the people who were foremost in the application of the results of scientific investigations to practical affairs, we might readily despair of the future of the human race.

The fact that many of the most destructive agencies are the products of scientific research should not be permitted to occupy the whole intellectual horizon. The destructive use is merely a misapplication of agencies whose proper application would be very beneficent. One need not be a devotee of the philosophy of materialism in order to appreciate the dependence of the well-being of a people upon the extent to which it exercises control over its material environment. The contribution of science is not, however, limited to giving man control of the forces of nature, but a necessary and inseparable concomitant is the widening of man's mental horizon, giving him a much broader and accurate vision of the truth.

The American people, as a whole, have a scant appreciation of this fundamental verity. We have been too busy depleting mother earth of her natural resources to give much heed or thought to the manner in which their efficient utilization has been brought about, and still more efficient utilization and conservation is to be secured. Most people seem to have a notion that the engineering apparatus and other agencies by means of which the great industrial development has been accomplished, came into being like a Topsy, or sprang, Minerva like, from the brain of some genius, and that this will be so in the future. With little realization of the scientific developments of the past, little attention is given to the best method of promoting development in the future.

Even a momentary consideration will convince the thoughtless that the fertility of the soil, unless restored, will, within a comparatively short interval of time, become exhausted. Furthermore, the mineral and other resources of the country have only a limited period of existence. Such facts make the man looking to the welfare of the future ponder how the advance already made can be maintained, and how human welfare can be still further advanced. The thoughtful man fully realizes that man's welfare is inseparably connected with his continued and accelerated control of forces and agencies at present unknown, and that this control can be secured only by patient, painstaking and thorough study of material and other phenomena.

The problem of the immediate future is to convince the unscientific element of a democracy of the essential truth of the foregoing statement. Scientific research is sure to be feeble and ineffective unless it is conducted in an appreciative and sympathetic atmosphere. We pride ourselves on being a practical people, but with reference to some of the most fundamental and important agencies of promoting national as well as individual welfare, we are woefully shortsighted, and refuse to feed the goose that lays the golden eggs. When a university appeals to the legislature for funds to carry on research, the response is usually half hearted, and the support is niggardly. Such support as is given is coupled with the injunction that none but practical subjects are to be investigated. That is, only those problems are to be taken up which promise immediate return, or for the solution of which there is a pressing industrial demand. The solution of such problems is legitimate and wholly praiseworthy, but it is entirely within the truth to say that of the agencies most potent in giving man control of his environment, and thus furthering human welfare, very few, if any, were discovered in response to a public demand. It is nearer the truth to say that one and all of these agencies were at first refused recognition as of any practical importance. Galileo, Kepler, Copernicus, and the many other investigators in the realm of astronomy were not attempting to discover laws and principles for promoting commerce, and yet when the late Joseph Langley was asked which of the sciences he considered to be the most practical, he promptly replied, astronomy. He further substantiated his reply by such a long list of the practical applications of the science that the most skeptical had to acquiesce.

Astronomy has, indeed, been potent in giving man control of his material environment, but it has been even of greater service in giving man a broader vision of the truth. Perhaps no other science has been so efficacious in driving the hobgoblins of superstition and fear out of man's imagination. Most certainly the motives that prompted the studies of the heavenly bodies and the laws that govern their motives were none of these.

The whole electrical industry with its incalculable

contribution to human welfare is founded on the scientific discoveries of a few men who did not have the slightest notion of the wide and varied applications of their discoveries. A more widespread acquaintance with these truths is imperative if scientific research is to flourish. On account of the genesis of the electrical industry, the votaries of electrical science understand and appreciate the importance of research to national welfare. Upon them and upon the participators of the benefits conferred by electrical science rests a great share of the responsibility of spreading the gospel of research. Every worker in any of the numerous applications of electrical science should get some appreciation of the dependance of national well being upon science and should do his "bit" in educating the public with reference to the necessity of a generous and sympathetic support of scientific research.

Transparencies in the Home

ELECTRICITY has accomplished much in the beautification of the home, but in the future we shall see more applications of an esthetic character than are at present even conceived. Only a beginning has been made, so to speak, in the co-operation possible between the interior decorator and the manufacturer of lighting equipment. As these possibilities are realized, new opportunities will constantly come forward which will mean an expanding market for the producer of appliances, increased revenue for the central station, and enhanced satisfaction to the residential customer.

One of these new lines which can be cultivated to advantage is the residential transparency. In thousands of homes photographic records of scenery are kept to recall, for instance, travels of household members in different parts of the country. It is but a step to obtain a transparency from an available negative, and modern processes of coloring make it possible to reproduce such views in a most natural and attractive way. Instead of the black and white or single tinted view of a noted canyon or waterfall, mountain range or seascape, we shall see in the not distant future colored transparencies designed to fit into frames within which low-powered incandescent lighting units will provide a luminous flux which will bring out the most beautiful effects. Advances in color screen design, too, will make possible changes in tinting that will enable the owner of such transparencies to see at nominal cost sunset and sunrise effects, moonlight tones, etc.

One has but to look at the development of talking machines and their artistic fittings to gain a hint of the possibilities of transparency development, even for homes of very moderate cost. The whole opportunity here rests upon the marvelous powers of light properly controlled, to enhance the decorative beauties of an occasion or a scene, and one of the best features of the whole matter is the small amount of energy which will be required to produce many of the effects wanted. With suitable reflectors even a five-watt lamp can be adapted to remarkably effective transparency service, and the cost of operating such an equipment for an evening of three or four hours would be less than one-fourth of a cent. At a trifling expense in proportion to the beautiful results obtained a colored transparency of the Grand Canyon, of Niagara Falls, of the ice-crowned battlements rising above Lake Louise in the Canadian Rockies could be provided for living room or music room, and from what we have seen in certain commercial developments along this line, there is no question that the decorative effects would be such, with proper treatment, as to make one fairly catch one's breath.

The connection between such themes of artistic decoration and increased profit to electrical manufacturers, dealers and central stations, may not appear very close at the moment, simply because very little such equipment is on the market, to the best of our information; but there is a real field for development here which may confidently be expected to add to the enjoyment of electrical applications in tastefully furnished homes. In some cases, doubtless, equipment may be developed for automatically changing screen tones in transparencies with the passing hours. We need not pursue these possibilities further at the moment other than to suggest that their first and operating costs will clearly be moderate in proportion to the results obtained.

Factors Affecting Central-Station Operation

BOTH the rates and the net income of an electric central station are to a great extent determined by the character and distribution of the load during the 24 hours of the day and 365 days of the year. The degree of uniformity of load distribution is dependent upon a variety of factors which in general may be called operating factors. Among the more important of these operating factors are load-factor, connected-load-factor, plant-factor, demand-factor and diversity-factor.

The effect of load-factor and diversity-factor on the capacity of a plant was shown by Professor Shuster, in his article on "Tendencies in Central-Station Practice," published in our issue of March 3. A knowledge of operating factors is essential not only for the construction engineer, but for the superintendent of operation as well. Each of the operating factors, using this term in a general sense, has an effect upon the efficient and economic operation of the central station, and in combination they disclose certain facts, which, when properly interpreted, are of great assistance in showing how more efficient utilization of the plant can be secured.

Before a proper interpretation of these factors can be made, a clear understanding of their significance, interdependence, and methods of calculation is essential. To aid those interested in acquiring such an understanding we publish on another page, the first of a series of three articles by Mr. Terrell Croft, on "Load, Plant, and Connected-Load Factor."

HAPPENINGS IN THE INDUSTRY

Report of Range Committee Meeting in New York—Program for Minnesota Electrical Convention—Status of Underground Construction for Boston Discussed—Amendments to Massachusetts Licensing Law Discussed—Importance of Accounting for Contractors Shown—Interesting Features of New Binghamton Plant—Miscellaneous News Notes

FINAL MEETING OF ELECTRIC RANGE COMMITTEE.

All Details of Report to Be Presented at Atlantic City Convention Completed—Great Future for Electric Cooking Predicted.

The last meeting of the electric range committee of the National Electric Light Association took place March 5 and 6 at association headquarters at 29 West 39th Street, New York, N. Y., lasting two full days and adjourning late Tuesday night.

The meeting was called to order at 10 o'clock Monday by Chairman Michel with the following members present: C. E. Michel, chairman, St. Louis; C. E. Greenwood, Boston; J. A. Abbink, Webster Groves, Mo.; Hartwell Jalonick, Dallas; C. N. Lewis, New York; H. E. Young, Minneapolis, Minn.; R. J. Patterson, Waterville, Me.; J. Paul Clayton, Mattoon, Ill.; R. B. Snyder, Milwaukee, Wis.; H. H. Russell, Dallas, Tex.; M. C. Morrow, Pittsburgh, Pa.; J. D. A. Cross, Pittsfield, Mass.; H. A. Lewis, Chicago, Ill.; H. P. G. Worstrand, Albany, N. Y.; Theodore Dwight, New York, N. Y.; George A. Bugher, St. Louis, Mo.; J. F. Killeen, Albany, N. Y.

The completed report of the committee this year is to be made up of the reports of the various subcommittees as approved by the general committee. The reports of all the chairmen of the subcommittees were received, considered in detail and approved for final inclusion in the final report. The greatest enthusiasm was shown in all the reports and deliberations of the committee and the opinion was unanimous that the electric range represents one of the largest fields for central-station endeavor in the immediate future. The report as completed will be presented at the annual convention of the association to be held at Atlantic City and it will undoubtedly lead to very thorough and interesting discussion.

DALLAS FRANCHISE SITUATION TO BE DECIDED BY VOTE.

Popular Vote in April Asked to Confirm Affirmative Post-Card Vote.

Interest in the Dallas lighting and traction franchises submitted to a post-card vote of the people last fall by the city commissioners through Messrs. Strickland and Hobson has been revived due to an announcement by the mayor that he would vote "no" on the franchise question at the city election next month. The mayor has been instrumental in getting Messrs. Strickland and Hobson to go into the local proposition and spent considerable time in the East working on the proposed franchises. While he has never come out directly and said he was in favor of the franchise, the opinion generally advanced has been that he was in favor of them. These franchises were overwhelmingly approved by the people of Dallas by means of a post-card vote taken last fall, but a referendum petition was obtained which made it necessary to submit the franchise at a regular election. The mayor has declared against the franchises because he says the amount Messrs. Strickland and Hobson propose to pay for the properties represent an excess value and that accordingly amount to perpetual franchise due to the fact that the franchise contains a clause stating that anyone taking them over in the future must pay the franchise valuation stipulated plus an additional 10 per cent. This amount he claims would be prohibitive. The mayor is a candidate for re-election.

PROGRAM FOR MINNESOTA ELECTRICAL CONVENTION.

Many Interesting Subjects to Be Discussed at Tenth Annual Convention at St. Paul, March 20 to 22.

A very interesting program has been arranged for the tenth annual convention of the Minnesota Electrical Association, which will be held at the St. Paul Hotel, St. Paul, Minn., March 20, 21 and 22. The first session on March 20 will be devoted to reports of committees and the address of President Ludwig Kemper.

There will be two papers at the afternoon session, one entitled "Construction, Maintenance and Inspection of Distribution Systems" by S. B. Hood, of Minneapolis; and a symposium on the subject of "Electric Cooking."

There will be two papers at the morning session on March 21, one entitled "Twenty-Four-Hour Service in Towns of 1,500 Inhabitants and Less" by Earle D. Jackson of St. Paul; and an illustrated paper by W. A. Durgin of Chicago entitled "Lighting, a By-Product or a Buy Product."

The following papers have been arranged for the afternoon session on March 21: "Affect of Load-Factor on Operating Cost, With Special Consideration of Desirable Customers and City Pumping," by E. T. Street, of St. Paul; "How Central Stations are Making More Use of Technical Schools," by Prof. George D. Shepardson, and "Principles of Rate-Making," by Prof. W. T. Ryan. The election of officers will take place at this session.

A question-box discussion, at which various topics of interest to central stations will be brought up, has been arranged for the concluding session on March 22.

The annual banquet and entertainment of the association will be held on Wednesday evening at the St. Paul Hotel.

F. A. Otto, of the St. Paul Gas Light Company, is secretary of the association.

STATUS OF UNDERGROUND CONSTRUCTION FOR BOSTON DISCUSSED.

Edison Company Making Every Effort to Eliminate Overhead Lines in Congested Sections.

Two bills providing for the general undergrounding of all electrical wires and cables in Boston were considered by the Legislative Committee on Public Lighting, February 27. One measure would cause all permits hereafter issued by the city to require underground construction, while the other bill would increase the yearly requirement from three miles of main streets and two miles of side streets to five miles of each. Both bills were introduced on petition of R. P. Delano, president of the United Improvement Association, who held that at the present rate it would require almost a century to accomplish all the burying of wires. He believed that the law is in some cases nullified by the practice of joint use of poles between the Edison and the telephone companies.

E. W. Burdett, for the Edison company, stated that the company has gone ahead of legal requirements and public sentiment in the matter of undergrounding. In 1894 the first measure was enacted, agreed to between the company and the city on every point. He had introduced 63 amendments, all of which were embodied in the act.

Every undergrounding act in the state, said Mr. Burdett, is working perfectly, because the parties got together in advance.

The Boston act required all wires in the business section of the city to be placed underground before 1900. The Edison company completed the work in 1899. The company's policy is to place all main lines to suburban districts and also lines in congested districts throughout its territory in conduits. This is not required, but is considered good business practice. The management regards overhead construction in urban centers and in all thickly settled districts as a type to be avoided. It has spent more than $13,000,000, or about two-thirds of the total outlay for the distribution system in Boston, on its underground work.

The wire department of Boston is now giving practically no permits for new overhead construction on public streets, said Mr. Burdett. It would be a hardship on the company, however, if all new construction should be required to be in conduits, since the Gas and Electric Light Commission now has authority to order services, and in some cases the requirement that they be underground would be burdensome.

Counsel for the telephone company stated that it had main conduits in 154 miles of Boston streets and laterals in 108 miles of streets. There are 1,100 miles of duct and 260,000 miles of wires. This is in the prescribed area alone, and there is almost as much additional mileage outside. In fact, more than 90 per cent of the system in Boston is underground.

Mr. Burdett added that the Edison company had expended $74,600 for underground work in 1907, and that the estimated cost for 1917 is $375,000.

Robert H. Holt, of the Boston Elevated Railway Company, stated that it had spent about $50,000 per year during five years past, to comply with the present law, and will spend about $65,000 per annum in the next five years, in Boston alone.

AMENDMENTS TO LICENSING LAW DEBATED.

Boston Contractors Advocate More Stringent Requirements to Raise Standard of Work.

Because municipal officials in Massachusetts who are charged with the enforcement of the electricians' licensing law do not realize their responsibility, the contractors and kindred interests have introduced a bill in the legislature making it obligatory on municipal inspectors and police officers to bring complaints of violations. Alfred J. Hixon, president of the Massachusetts Contractors' Association, and Frank L. Barnes, of the Barnes-Pope Electric Company, Boston, recently appeared before the Public Lighting Committee advocating this measure, and an amendment which sets 21 years as the minimum age for application for a journeyman's license. They held that some trades and correspondence schools are giving boys just enough information to make them dangerous, and believed that at least three years' experience should be a prerequisite to certificate solding. It is further proposed to make the fee for reexamination one dollar instead of 50 cents, and to make it obligatory to ask for the renewal of a license of either class within 30 days after expiration.

Representatives of organized labor were divided on the bill, D. G. Kimball, of the National Association of Stationary Engineers, opposing it on the ground that it was a hardship on operators of independent steam plants having electrical equipment under their care to take an examination and obtain a certificate. J. H. Devlin, Jr., of the legal department, City of Boston, believed the measure to be too arbitrary in its enforcement provisions. Representatives of the State Confederation of Electrical Workers and of the Electrical Workers of Springfield, Mass., advocated the bill and believed there should be two state inspectors-at-large to secure enforcement. Objection that this would involve expense on the state brought out the statement from former clerk Dallas of the Examining Board, that the fees received are about $25,000 per year and the expense of the department for 1.5 years thus far, $7,000.

JOVIANS ENCOURAGED TO TAKE INTEREST IN CIVIC WORK.

Mayor of Kansas City and Jupiter Doherty Predict New Era in Jovianism.

Mayor Edwards, of Kansas City, Mo., urged the Jovians at their semi-monthly meeting, March 2, to consider carefully the city charter, which is to be voted on soon, and H. L. Doherty, reigning Jupiter of the Order, followed the mayor with the declaration that Jovians were expected to take a deep interest in civic affairs. Mr. Doherty said that he foresaw very large growth for the Jovian Order, which represented an industry that was yet in its infancy; and that as the membership increased, the mmbers would feel their responsibility as Jovians and as citizens more fully. He announced that at a future meeting of the Kansas City League he would outline plans he had been considering for the expansion in the activity of the Order.

A meeting of chairmen of committees with the executive committee was held after the luncheon, P. L. Lewis, president, directing the conference on the progress of the various lines of work.

IMPORTANCE OF ACCOUNTING FOR CONTRACTORS SHOWN.

Massachusetts Contractors Discuss Bookkeeping Methods at Meet in Boston.

About 150 members of the Electrical Contractors' Association of Massachusetts met in mid-winter convention at the Quincy House, Boston, February 21. A reception and executive session of members occupied the late afternoon, and after the dinner Alfred J. Hixon, president of the association, spoke on some concrete means of making the organization helpful to its members. These he held to be co-operation, individual effort, and loyalty to the association. The contractors propose to wage an aggressive campaign for new legislation which will strengthen the present licensing law.

A feature of the evening was an address by M. A. Curran, general credit manager, Western Electric Company, New York, on "Bookkeeping and Accounting From the Contrator's Point of View."

Mr. Curran pointed out that the contractor's position in the industry is assured. He is the final link in the chain of serving electric power to the public. The public is willing to pay the contractor all that his services are worth, and there should be a strict method of cost accounting by businesses, both small and large.

"No contractor fears intelligent competition," said the speaker. "It is the irresponsible type of competition that is a menace to the contractor and to the industry as a whole."

Mr. Curran commended the system of accounting issued by the National Contractors' Association. Contractors generally are remiss in accounting methods. Their overhead expense is often not properly determined, nor properly porportioned to estimates and bills for work done. The use of a flat percentage is unsafe; better practice is

to figure in terms of dollars, bearing in mind that small jobs, which are a large share of the contractors' business, cost more proportionately for estimating, selling and executing than do large jobs.

It is very desirable to send the proper material, in complete quantities, to the job. Otherwise, expensive delays occur. The cost of material and payrolls and incidentals on each job should be cleared through the accounts, and applied against each job's cost sheet. This enables the contractor to keep a check on his estimates.

Mr. Curran believed it bad practice for a contractor to buy supplies in too large quantities, the trade discounts often being insufficient to offset the difficulties arising from tieing up the amount of capital required.

Collections should be made by mailed statements and, ultimately, written requests for payment, rather than by personal calls, which are expensive in time, and often annoying to the customer.

Customers should not make cash withdrawals without keeping a systematic record, and it is best to draw a regular weekly salary. Surplus earnings should be regarded as dividends and withdrawn at stated intervals. Contractors lacking an ample amount of capital to carry their business should not tie themselves up with real estate investments, which are slow in realizing returns; neither should they invest in extravagant store furnishings. Failures more often result from lack of capital than from other causes. Business competence is, however, the great essential to success.

MANY INTERESTING FEATURES FOR NEW BINGHAMTON PLANT.

High Steam Pressures With Comparatively Small Generating Units Make Small Space Necessary for Building.

The Binghamton Light, Heat & Power Company, which serves territory including Binghamton, Johnson City and adjacent towns, has under construction a new power plant located in the town of Union four miles west of Binghamton on the line of the Delaware, Lackawanna & Western Railroad, where the railroad crosses the Susquehanna River. There will be installed within the next few months, generating capacity amounting to 5,500 kilowatts delivering energy at 2,300 volts, three-phase, 60 cycles. The two generators will be respectively 2,000 kilowatts and 3,500 kilowatts capacity. Three boilers, each 600 horsepower, will supply steam at 200 pounds pressure, 100 degrees superheat. This installation takes the space furnished by the first four bays in the plant, while plans are under way for the immediate addition of three more bays to the building, allowing the installation of the third generating unit of 5,000 kilowatts capacity and two more 600 horsepower boilers.

The chimney, 12 feet in diameter, 200 feet high, is provided to take care of total boiler capacity up to this point: that is, five 600-horsepower boilers. The cross section of the plant is arranged so that the turbine room is on the left-hand side of the building. The middle section is taken up by firing floor for the boilers and by suspended coal bunker over the firing floor with generous provision for ventilation by means of swinging sash in the sides of the monitor over the bunker.

The right-hand side of the building containing the boiler and the chimney is located outside of the right-hand wall and so located as to take care of the five boilers with the shortest possible flue. The basement floor is 17 feet six inches below the main floor, and the dividing wall is placed under the front boiler columns so as to place all the auxiliaries, including boiler-feed pumps and the forced-draft fans, under the same supervision as the condenser auxiliaries. Along the left-hand side of the basement are grouped the 2,300-volt switches which are controlled by the bench-board located directly overhead on the turbine-room floor. All steam-driven auxiliaries, with the exception of the stoker engines, are equipped with turbines. High-pressure piping, including the valves, are of steel construction.

This plant illustrates the fact that under present practice operating boilers at high rating and where generating units are of medium capacity it is possible to make a comparatively narrow building contain apparatus so distributed as to utilize the space to the best advantage and that this space is very much less than would have been required some years ago under the old method of operating boilers.

Running at right angles to the front of the plant is a railroad siding which will enable five carloads of coal to be handled at one time. Continuous supply to the plant is arranged for by a tunnel running from this siding to the basement. This tunnel contains conveying apparatus and a crusher, and discharges coal to an elevator just inside of the front building wall, which elevates and distributes the coal to the suspended bunker. Coal feeds by gravity from this bunker through individual scales to each stoker.

Ash handling is reduced to the simplest terms. Small side-dump cars are brought in directly under the ash hoppers which are so arranged as to dump through large under-cut gates. These cars are on the basement floor, which is approximately at the ground elevation, and there is sufficient area on the adjacent property to furnish dumping facilities for some years to come.

The demands of this territory are such as to require provision for continuous growth of this plant, and it may be expected that the capacity now planned for will have to be increased probably next year and the amount of increase can best be determined later. The company has acquired a piece of property which is large enough to allow for almost unlimited growth in plant capacity.

In order to take care of distribution of energy an outdoor station is under construction directly alongside the building on the left-hand side. This outdoor station will contain step-up transformers from which distribution lines will be taken to various parts of the territory. There will be a substation in the center of Binghamton, which will take over the distribution which centers in the old plant now in operation and which plant it is expected will be abandoned next year.

Proposed Martin Bill Would Impair Effective Commission Regulation in New York.

A memorandum pointing out serious objections to the so-called Martin Bills now pending before the Legislature, the effect of which would be to alter the present statutes in respect of decisions by certiorari, has been adopted by the Public Service Commission for the First District of New York on motion of Commissioner Travis H. Whitney, and has been forwarded to Senator Charles D. Newton and Assemblyman Fred M. Ahern, chairman of the Codes Committees respectively of the two houses of the State Legislature. The memorandum states the opposition of the Commission to the measures in question and in part says: "These bills will greatly impair prompt and effective regulation by the Commission, orders of the Commission being reviewable by a writ of certiorari. The Court of Appeals has recently held that upon such review the Court may not substitute its own judgment for that of the Commission in determining the reasonableness of an order. In other words, the findings of fact by the Commission, as by a jury are not to be set aside because the Court might have come to a different conclusion. These bills would set aside the decision of the Court of Appeals in that they specifically provide for a review of the facts and are undoubtedly the answer of the public service corporations to that decision."

Miscellaneous NEWS NOTES

Central Connecticut Electric Light Company Formed.—The Connecticut Public Utilities Commission has approved a petition of the East Haddam and the Colchester Electric Light Companies to merge into one corporation to be called the Central Connecticut Electric Light Company. The majority of stockholders in both companies, and the management, have been identical.

New Officers for American Institute of Consulting Engineers.—At the council meeting of the American Institute of Consulting Engineers, held in New York on February 6, officers were elected as follows: President, George Gibbs; vice-president, Lewis B. Stillwell; secretary and treasurer, F. A. Molitor. New members of the council elected were as follows: A. M. Hunt, Lewis B. Stillwell, William J. Wilgus and Gardner S. Williams.

The Elements of Illumination.—At the March meeting of the New England Section, Illuminating Engineering Society, held at the Massachusetts Institute of Technology, Cambridge, Mass., on March 7, Prof. William C. Wickenden presented a paper entitled "The Elements of Illumination," which dealt in a comprehensive manner with a study of the basic principles upon which the science of illumination is founded.

Determination of the Audibility Current of a Telephone Receiver.—Prof. Edward W. Washburn, of the University of Illinois, presented a paper entitled "The Determination of the Audibility Current of a Telephone Receiver," at the meeting of the Institute of Radio Engineers, held in the Engineering Society's Building, New York, N. Y., on March 7. Prof. Washburn described a new method of determining this important quantity and his discussion provoked much comment.

Fraternity Convention at Champaign.—The thirteenth annual convention of Eta Kappa Nu, an honorary fraternity of electrical-engineering students will be held March 16-17, at the University of Illinois, Champaign, Ill. Alumni chapters from New York, Pittsburgh, Schenectady, Chicago, Milwaukee and St. Louis, will attend. All Alumni members in the vicinity are extended an invitation to attend the two-day meeting. Prof. L. H. Harris, University of Pittsburgh is secretary.

Minneapolis Jovians Hold Get-Together Dinner.—Over 200 electrical men were in attendance at a get-together dinner held in Minneapolis, Minn., the evening of March 8, under the auspices of the Minneapolis Jovians. The main purpose of the meeting was to bring those engaged in the electrical business in Minneapolis in closer touch with each other and foster the co-operative spirit of the Jovian Order. The affair was voted a success from every standpoint and the benefits will undoubtedly be felt for some time to come.

Texas Independent Telephone Association Elects Officers.—The twelfth annual convention of the Texas Independent Telephone Association was held at Fort Worth on February 22, 23 and 24. There was an attendance of about 350 representative telephone men. At the closing session of the convention on Saturday, the following officers for the ensuing year were elected: R. R. Still, of Tyler, president; A. J. Combs, of Haskell and F. W. Graber, of Brownwood, vice-presidents; F. C. Bloymer, of Waco, secretary; F. M. Powell, of Dallas, treasurer, and L. D. Gardner, of Waco, membership secretary. The two directors who were re-elected are T. P. Stillwell, of Lone Oak, and D. O. Hazelton, of Dalhart. The new directors elected are A. V. Ward, of Pfleugerville; C. D. Longseare, of Bardwell; A. U. Weaver, of Santa Anna; J. W. Oxmont, of Palestine, and J. Y. Rust, of San Angelo. The following were elected members of the advisory board: J. R. Earl, S. A. Lindsay, C. A. Shock, J. C. Casler and Judge G. N. Harrison.

Dallas Electric Club to Enter Float in Civic Parade.—The Dallas Electric Club and Jovian League, Dallas, Texas, is building a very attractive float to be entered in the annual spring style-show parade, which is to be held in Dallas next month.

Kings County and Edison Electric Elect Officers.—At a meeting of the stockholders of the Kings County Electric Light & Power Company and the Edison Electric Illuminating Company, of Brooklyn, N. Y., the following boards of directors were elected: For the Kings County company: Frank Bailey, William Berri, James C. Brady, Nicholas F. Brady, William C. Courtney, Daniel J. Creem and W. F. Wells was re-elected vice-president of both companies. For the Edison company: Walton Ferguson, Bernard Gallagher, William V. Hester, Adrian T. Kiernan, Thomas E. Murray, W. F. Sheehan and James N. Wallace.

Construction on New Toledo Station Rapidly Progressing.—Work on the new power house of the Toledo (O.) Railways & Light Company, is being rushed to completion, the full 24-hours being utilized. The property on the old rolling mill grounds is being filled out to the dock line, which will give the company one of the finest and most valuable sites in the heart of the city where lake vessels can unload at the front and coal trains at the back. There will be ample storage space for coal so that a six-months' supply can be kept on reserve at all times, thus safeguarding the electrical users of Toledo against any shutting down of service. Construction work is under the supervision of Henry L. Doherty & Company.

New England Commission Decision.—The Maine Public Utilities Commission has handed down a decision directing the Wiscasset Electric Light Company to perfect its service with all possible expedition, and to give the public a reasonably constant and adequate service, without regard to the inability of the company supplying it with current to meet the requirements. Energy is obtained from the Portland Power & Development Company, there being no local generating station. The stock control has been acquired by the Central Maine Power Company, which has extended lines to Wiscasset, with prospect of a better supply of current than obtainable heretofore in that district.

City Expert Opposes Municipal Ownership.—At a recent hearing before the Massachusetts Gas and Electric Light Commission on the rates charged by the Boston Edison Company for city lighting, Professor Harry E. Cifford, expert for the city, under cross examination expressed his disfavor of municipal ownership of the electric plant in Boston. He held that if divorced from politics, as low a scale of prices might be obtainable as under private ownership, and admitted that the city is benefited by being connected with a large system of supply having low generating costs and operating expenses, which is true of the Boston Edison Company, because of the large and systematic way in which the problem is handled by the company.

Snow Storm Causes Damage in Louisville.—Wire distribution systems over Kentucky were badly affected during heavy falls of wet snow on the last of February and the first few days of March. Telephone lines in all parts of the state were the chief victims of the unusual conditions, thousands of telephones in Louisville alone having been put out of commission. The telephone companies put all the men they could employ and borrow from other concerns at work on the repairs, but service was not fully restored for the better part of the week. Continuation of the snowy weather added to the difficulties. More or less similar conditions were reported from all parts of the state and section where similar conditions had to be dealt with.

Protective Relays on Chicago System

Description of the Practice of the Commonwealth Edison Company, of Chicago, in Using Relays in the Protection of Important Transmission and Tie Lines—Abstracted From the Paper Presented Before the American Institute of Electrical Engineers

By R. F. SCHUCHARDT

PROTECTIVE relays on a central-station system may be defined as devices or apparatus used primarily to maintain continuity in the supply. The protection is with reference to the service rather than to the generator, line, or transformer, etc., to which the relay is connected. The ideal protective relay is one that immediately disconnects a faulty member of the system before the disturbance caused by the fault has spread beyond that member. Unfortunately, development to date has not yet evolved such an ideal device. Synchronous apparatus has a tendency to drop out of step promptly whenever an unusually heavy shock occurs on the system, thus at times causing disturbance in other than the faulty member. However, the relays now available will serve properly in the great majority of cases, and we may hope ultimately to have

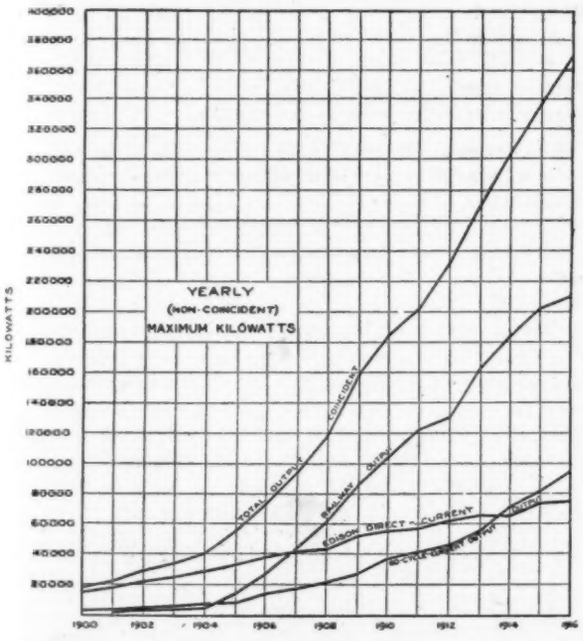


Fig. 1.—Maximum Loads on Commonwealth Edison System Since 1900.

synchronous apparatus designed with a higher degree of stability.

At the present time the conditions met with in different systems vary considerably, and no one scheme of protection will fit them all. Each system must be studied, and the individual solution applied. There are, however, many points of similarity, and the solution in one case will serve as a partial guide, at least, in others.

The tendency in the development of large systems is toward the simplicity of the low-tension Edison network, which is giving such excellent results. Unfortunately, the protective problem on these large high-tension systems has not the simplicity of the Edison network. We seem, however, to be in a fair way of making satisfactory progress toward this goal. The devices now obtainable and commercially within reach make it practicable to interconnect quite freely, and thereby to gain considerably in the use of the copper invested in lines, and, in general, to localize faults.

It is only fair to the manufacturer to state that his problem has not been an easy one, since the ideal action of

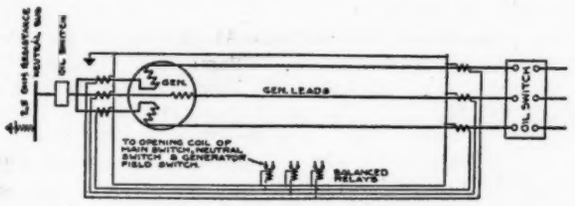


Fig. 2.—Merz-Price Relay on Generator.

protective relays would require them to have almost human intelligence. They must invariably discriminate between conditions under which they ought to operate and those under which they must remain inoperative, and this discrimination must be made instantaneously. The present apparatus made by the manufacturers reflects credit on their engineers, and gives promise of continued progress along the desired lines.

In the following paper will be found a description of the protective schemes recently adopted by the Commonwealth Edison Company, of Chicago, as a result of considerable

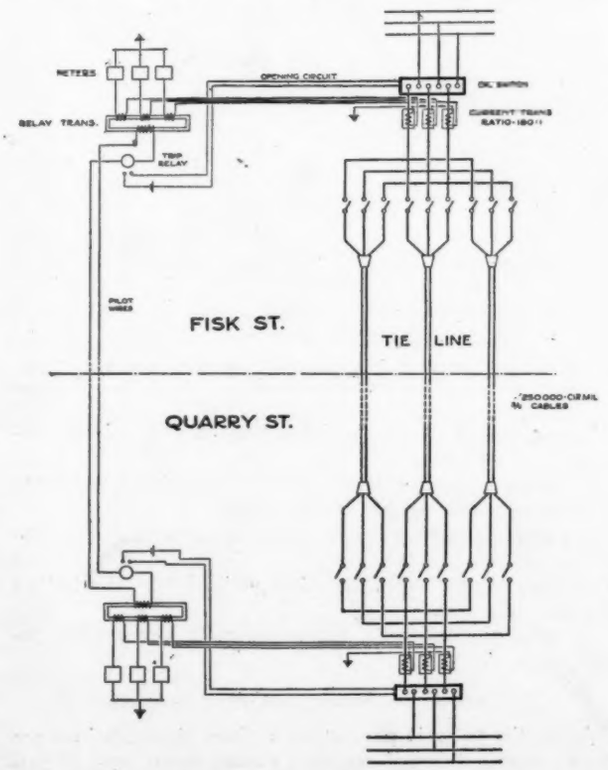


Fig. 3.—Diagrammatic Sketch of Relays Used on the Fisk-Quarry Tie Lines.

experimentation with the newer relays. With the continued growth of the system the earlier relays were frequently found inadequate, and it was necessary to seek relief in a better development in order to continue the maintenance of satisfactory service.

The plant of the Commonwealth Edison Company contains at present three main high-tension generating stations with a number of auxiliary peak stations, having a total generating capacity at this time of approximately 400,000 kilowatts, with 800 miles of high-tension transmission lines feeding 66 distribution substations and about 40 industrial customers' substations. The energy is generated at two frequencies, 25 cycles and 60 cycles. Summarized substation data are shown in Table I. The size of the system and its growth are indicated in the curves in Fig. 1, which show the annual maximum loads since 1900. The total coincident maximum during the past winter was 370,000 kilowatts.

TABLE I—SUMMARY OF SUBSTATION CAPACITY DATA.

	25 Cycle		60 Cycle	
	Total kw. capacity	Range of sizes	Total kw. capacity	Range of sizes
250-volt synchronous converters on Edison system	101,300	100–4200		
600-volt synchronous converters for railway service	*226,000	1000–4000	9,000	3000
12,000-volt to 4,000-volt transformers			102,500	100–3000
Frequency changers	21,500	500–2000		
Total	348,800		111,500	

*140,000 kilowatts of this is in substations of the traction companies.

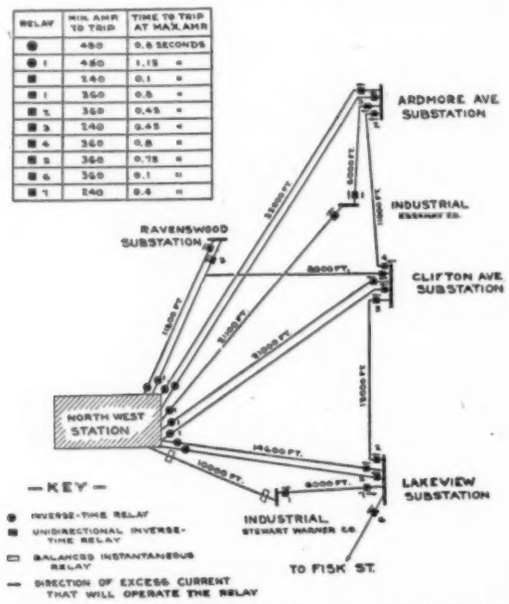


Fig. 4.—Typical Protective Scheme as Used for North Side Transmission Lines.

The length of the transmission lines at the various voltages is as follows:

481 miles of 9,000-volt, 25 cycles; cable size 4/0, 250,000 circular mils and 300,000 circular mils.

215 miles of 12,000-volt, 60 cycles; same cable as for 9,000 volts.

92 miles of 19,000-volt, 25 cycles; cable size 2/0 and 250,000 circular mils.

12 miles of 22,000-volt, 60 cycles; cable size 250,000 circular mils.

Elements of the System and Their Protection.

All of the 25-cycle generators in these three stations are provided with external reactors, except in the case of two of the units which generate at half pressure and step up to 9,000 volts through autotransformers. The total reactance

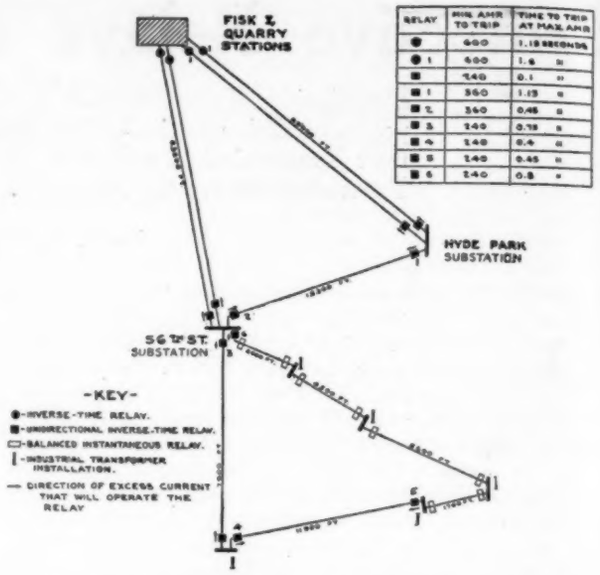


Fig. 5.—Typical Protective Scheme as Used for Southeast Transmission Lines.

of generators and external coils (or autotransformers) is as follows:

12,000-kw. capacity generators	8 per cent
14,000-kw. capacity generators	8 per cent
20,000-kw. capacity generators	10 per cent
25,000-kw. capacity generators	11 per cent
30,000-kw. capacity generators	12 per cent
35,000-kw. capacity generators	12.5 per cent

The 60-cycle generators have sufficient inherent reactance, so no external reactors are required, this reactance being:

14,000-kw. (18,670-kv-a.) capacity generators	7 per cent
20,000-kw. (25,000-kv-a.) capacity generators	12 per cent
30,000-kw. (35,300-kv-a.) capacity generators	12.5 per cent

With one exception the vertical generators, which include all those under 20,000-kilowatt capacity and two of this capacity, have no automatic relays at present. All of the newer units and one of the 20,000-kilowatt vertical units are equipped with balanced relays of the Merz-Price type. These are connected so that in the event of a fault in the generator or in its leads, they will promptly open the main oil switch, the neutral switch (if closed), and the field

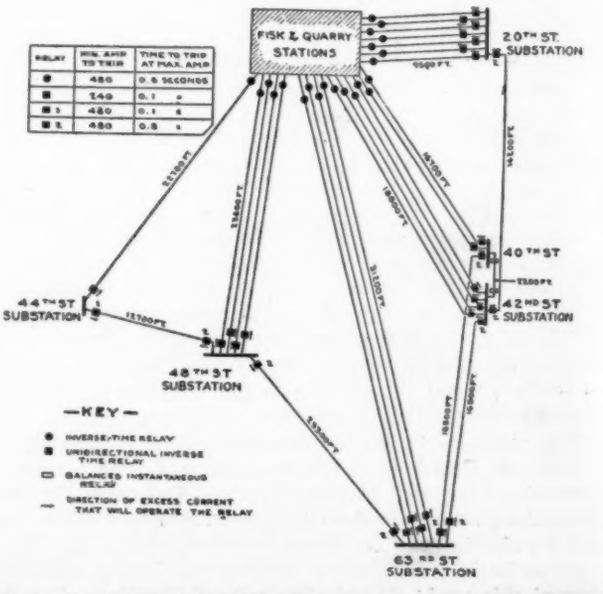


Fig. 6.—Typical Protective Scheme as Used for South Side Transmission Lines.

switch of the faulty unit. A diagram of this relay connection is shown in Fig. 2.

Fisk Street station is normally operated in two sections, which, however, are tied together through the Quarry Street bus, sectionalizing reactors being placed in each tie line. These reactors are designed to absorb 20 per cent of the pressure at the full-load current of the tie line, which consists of three 250,000 circular mil cables in parallel. These tie lines are protected with balanced relays, the connections of which are shown in Fig. 3. It will be noted that the connections are such that the relays will operate only in the event of ground current, but experience has indi-

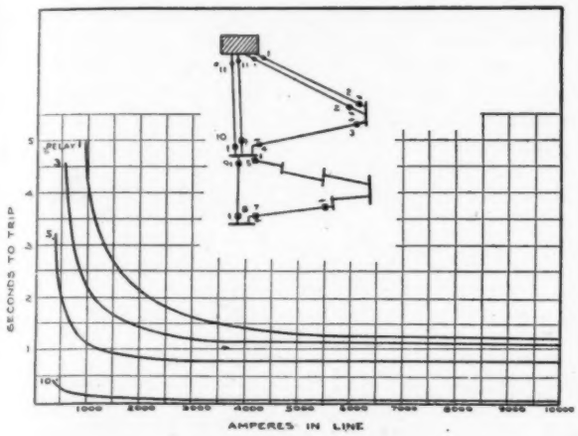


Fig. 7.—Current-Time Curves of Relays.

cated that the vast majority of cable failures are to ground. Incidentally this could always be assured if cable of the Hochstaedter type—that is, with grounded sheaths around each conductor of the three-conductor cable—were used. Tie lines between Fisk Street and Northwest station, which are about eight miles long, are treated like ordinary lines at each station. On each of the sections, both for the 25-cycle and the 60-cycle units, the neutral switch of one of the running units is closed to the neutral bus. Each section has its own neutral bus, and this is connected to ground through a 2.5-ohm non-inductive resistance.

At the Quarry Street station there is a 5,000-kilowatt fre-

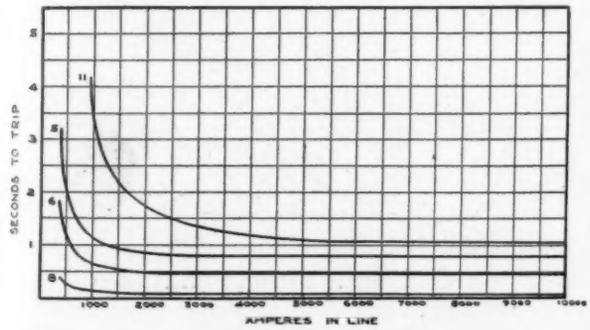


Fig. 8.—Current-Time Curves of Relays.

quency changer serving as tie between the 25-cycle, 9,000-volt buses and the 60-cycle, 12,000-volt buses. The bellows overload relays now on the units are to be replaced by uni-directional relays at either end, and in addition an adjustable definite-minimum, inverse-time-element relay will be installed to trip the 60-cycle switch in the event of a sustained excessive overload, such as would result when either of the systems receives a shock and excessive synchronizing energy passes between them through this frequency changer. The uni-directional relays will be set to operate instantaneously on energy feeding inward and equal to about 15,000-kilovolt-amperes, while the inverse-time relay will be set for approximately 10,000 kilowatts, three seconds.

On the transmission lines in the generating stations the bellows-type relays are being rapidly replaced by an induction-type, adjustable definite-minimum, inverse-time-element relay. Where the line is part of a ring and the time setting of the relay at the station end is more than one and one-half seconds, an additional relay of the same type is used, but set to operate instantaneously. Its current setting, however, is slightly higher than that current which could flow over the resistance of this line and into the next link of the ring. It is planned ultimately to operate lines in parallel, wherever practicable and consistent with the sectionalizing at the generating stations.

At the substation end of these lines, as well as on tie lines between substations, there are connected uni-direc-

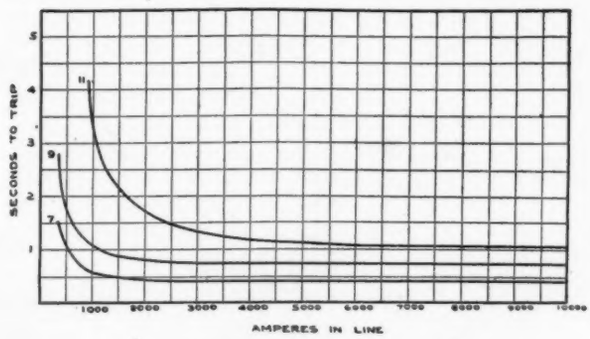


Fig. 9.—Current-Time Curves of Relays.

tional inverse-time-element relays of the induction type, or in some instances on rings, balanced relays, depending on the relation of the particular line to the other elements of the ring of which it is a part.

Protective apparatus in use on substation units is as follows:

On 250-Volt Synchronous Converters of the Edison System. Inverse-time-element overload relays of the bellows type on the high-tension supply to the transformers and operative on the oil switches; speed-limit devices operating on the direct-current circuit-breakers; and on all downtown sub-

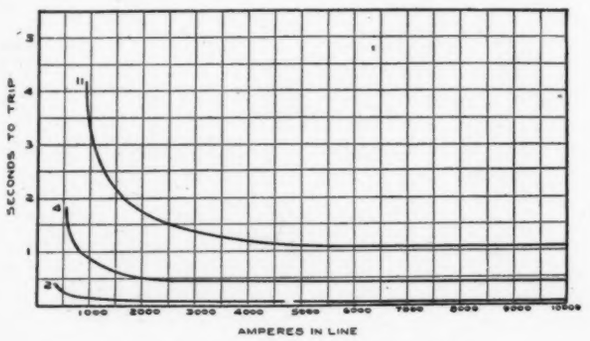


Fig. 10.—Current-Time Curves of Relays.

station units in addition reverse-current relays operating on the direct-current circuit-breakers.

On 600-Volt Converter Units for Railway Service. Inverse-time-element overload relays operating on the oil switch; overload attachment on the positive circuit-breaker; speed-limit relays operating on the positive circuit-breaker; and in addition a special leakage-current relay connected between the frame of the machine and earth and set to operate both the oil switch and the direct-current breaker in the event of potential in excess of 100 volts existing on the frame, such as might result from a flashover.

On 60-Cycle, 12,000-Volt to 4,000-Volt Transformers. Bel-

lows overload relays operating on the 12,000-volt switch are being replaced by differential relays operating on both the 12,000-volt and the 4,000-volt oil switches. The 4,000-volt outgoing-feeder circuits are provided with straight overload relays.

On 9,000-Volt, 25-Cycle, to 4,000-Volt, 60-Cycle Frequency Changers. Bellows overload relays on both the motor and the generator, each operating its own oil switch.

Setting of Relays and Experience.

Generators. The balanced relays on generators are, like all the other balanced relays on the system, set for instantaneous operation. Since they have been installed, the relays on one of the units have been called upon to operate twice, in each case promptly disconnecting the unit. The benefit of generator reactors and bus-sectionalizing reactors has been apparent a number of times in limiting the extent of the disturbance resulting from a line breakdown close to the station. Previous to the installation of such reactors, cable breakdowns occurring within half a mile of the station usually caused fairly widespread disturbance and often considerable damage to generators.

Lines. The adoption of the line protective devices described resulted from a desire to make the large line investment more productive by operating in parallel as far as practicable, as well as to localize more fully the disturbance resulting from a cable failure. In the case of the station tie lines, the straight inverse-time-element relays frequently opened when either station got a shock due to a line failure.

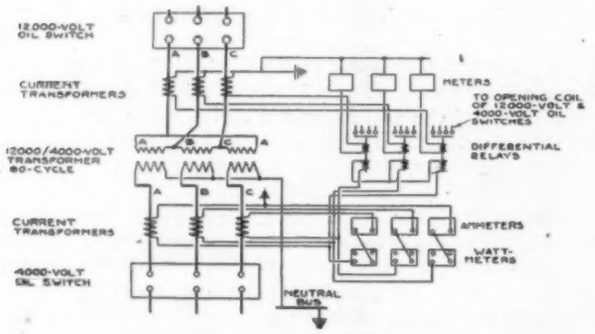


Fig. 11.—Differential Relay on Substation Transformer.

The installation of balanced relays on these two lines has entirely removed this trouble.

On the transmission lines, the aim is to use the induction type of relays in all cases where their satisfactory use does not require the time setting at the station to be too high, and it was generally considered that this maximum setting should not materially exceed two seconds. In the case of ring-connected lines, where the succeeding relays in each link, counting toward the station, must have an increasing time element, the use of these relays only would in many cases require a setting in excess of the two-second limit. It is obvious that the difference in time setting between any two successive relays in the series must be equal to the time required for the oil switch to fully break the circuit after the relay contact has closed, plus a safe margin, and this, with the speediest apparatus, is approximately three-tenths of a second. In order, then, to keep down the total number of such relays in series in a ring of many links and thus to prevent the above time limit from being exceeded, the shortest lengths in the ring are provided with balanced relays and pilot wires. The illustrations in Figs. 4, 5 and 6 show typical installations of relays on a few sections of the system. The data of the settings are also given. The current-time curves of a set of uni-directional relays in a ring are given in Figs. 7, 8, 9, and 10, and show clearly how the selectiveness of operation is obtained at all current values.

It will be noted in Fig. 4 that in the case of the line to Lake View substation, which loops through an industrial installation, the rule of applying the balanced relays to the short length has not been followed. In cases like these the preference for the balanced relay is given to the section nearest the generating station, even though this section may not be the shortest, the reason being that the balanced relay, having a practically zero time setting, would disconnect the line in case of a short-circuit close to the station more promptly than would a relay with a definite-minimum time setting.

Substations. The bellows overload relays on the high-tension side of substation units are set to operate at a minimum flow of approximately two and a half times rated current, to operate in two seconds on three and a half times, and instantaneously on five times rated current. On synchronous converters the speed limit is set at 15 per cent over speed. Differential relays on substation transformers are arranged for instantaneous operation, and are shown diagramatically in Fig. 11. The relays on the 4,000-volt feeders are of the instantaneous type and set to trip at three times normal load.

There is a considerable number of minor installations of protective relays on the system not covered in the above, but for sake of brevity and because they have no features of special interest they have here been omitted.

Government Report on Cuban Market for Electrical Goods.

Cuba's present-day needs in electrical goods are described thoroughly and graphically in a report which the Bureau of Foreign and Domestic Commerce is now distributing. The author is Philip S. Smith, who is making an extended study of Latin-American markets for American electrical goods. Mr. Smith is not only an electrical engineer, but for a number of years was actually engaged in the business of exporting electrical goods.

The report on Cuba is the first of a Government series which should find its way into the hands of every man in the country who is or ever expects to be interested in the sale of electrical goods to foreign countries.

The following list of chapters will give an idea of the scope of this first report and to a certain extent of the reports to come: Introduction, Central Stations, Lighting, Heating Devices, Miscellaneous Applications of Electricity, Power for Sugar Mills, Possible Future Field for Electricity, Customs Classifications of Electrical Goods, Statistics of Imports, Packing, Trade-Mark Registration, Advertising, List of Dealers and Users.

There is a nominal charge of five cents for this 40-page report, which may be obtained by addressing the Superintendent of Documents, Washington, D. C.

Moving-Coil Galvanometers for Alternating-Current Measurements.

Some years ago a general investigation of galvanometers was begun because the best galvanometers then obtainable on the market were not sufficiently sensitive for some of the work of the Bureau of Standards. Results on permanent-magnet moving-coil galvanometers for direct current and on vibration galvanometers for alternating current have been published in the bulletin of this Bureau. A paper now published as Technologic Paper No. 297 gives the results of an investigation of alternating-current galvanometers of the separately excited, iron-cored electrodynamometer type. These results should be of interest to the maker and user of such instruments, since it is shown how the operating constants (the sensitivity, period and damping) depend upon the construction constants, upon the excitation and the electrical constants of the moving-coil circuit.

Electricity in a Large Lumber Mill

Some Information Relative to the Selection of Motors for Lumber Mills, Types of Drive to Use and Advantages of Individual Motor Drive, Based on the Installation in the Plant of the Detroit Lumber Company

Industrial Power Series—Article No. 194

A MOTOR installation of more than passing interest is that in the plant of the Detroit Lumber Company, of Detroit, Mich., which is one of the most modern complete planing mills and interior-finish factories in existence. It occupies approximately 17 acres of land, with a water and dock frontage of 1,400 feet.

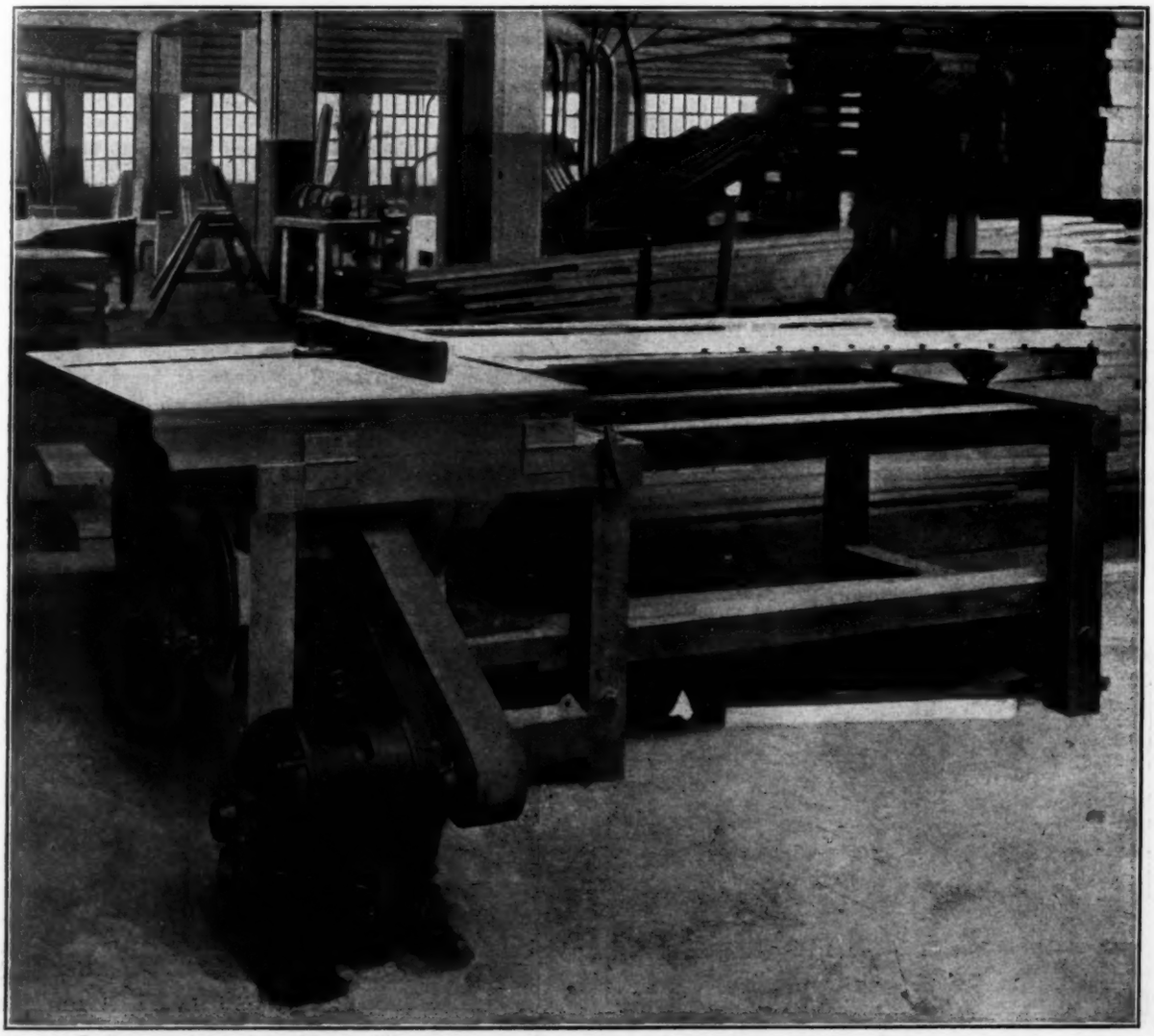
The approximate size of the dock facilities of the Detroit Lumber Company can be appreciated from the statement that 3,000,000 feet of lumber can be loaded simultaneously at the dock. The warehouse capacity is 200,000 feet of finished lumber, and the kilns have a capacity of 200,000 feet per month. The mill building proper is 220 feet by 150 feet, and is three stories in height. The first floor of this building is used as a planing mill, and the second and third floors as interior finish factories. The building has a floor space of approximately 85,000 square feet.

The mill contains 82 Wagner motors, each individually connected to a woodworking machine. These motors vary in size from one to 50 horsepower, the aggregate rating being 828 horsepower. With but few exceptions all motors are polyphase machines, known as type BW, with no exposed contact-making parts.

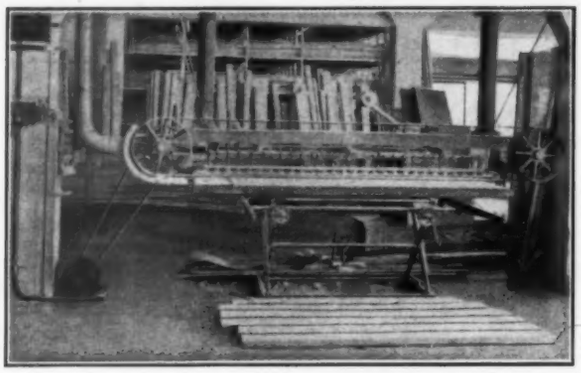
The accompanying illustrations show several of the motor applications and convey, in a measure, an idea of the scope of the installation. The accompanying table covers the most important of the 82 motor installations, some of which are in duplicate.

Advangtaes of Electric Motor Drive.

In considering the Detroit Lumber Company's plant as an example of the best practice in regard to motor drive it may be of interest to review briefly the advantages of electric drive, which undoubtedly had a great deal to do



A Three-Phase Squirrel-Cage Motor Belted to a 16-Inch Table Saw—Detroit Lumber Company.



Two-Horsepower Squirrel-Cage Motor Driving a Belt Sander in Detroit Lumber Company's Plant.

A 10-Horsepower Motor on Left Driving Surfacer—Five-Horsepower Motor on Right Driving Jointer.

with the decision of the company to electrify.

Motor drive is of particularly great advantage to those plants where the output varies periodically. It should be kept in mind that when a small percentage of machines in a department are operated that the magnitude of the friction losses is many times that of the useful work, and that most of these losses would be eliminated by the use of motor drive. This is particularly true in overtime work.

A breakdown in the main part of the mechanical drive usually necessitates a complete shutdown of the factory. Trouble with motor drive is confined to one machine or to a group of machines.

Motor drive permits the most economical use of floor space. There is no need of a motor occupying floor space. On account of its compactness and smooth-running characteristics it may be mounted on the machine, placed under the machine, or attached to the wall or ceiling. The machines can all be located with regard to obtaining the maximum output, which can rarely be done when the machines must be driven from line shaft.

In many woodworking plants the number of holes in the floor through which belts pass to drive separate machines on the floor above have increased the fire risk. In case of fire each opening becomes a chimney which fans the fire and carries it from floor to floor.

Experience has proven that motor drive has decreased the number of accidents. Direct-connected motors; elimination of belts passing through the floors; stopping the motor quickly from several places about the machines, which may be done with very simple and inexpensive control apparatus, have all contributed toward decreasing injuries to employees.

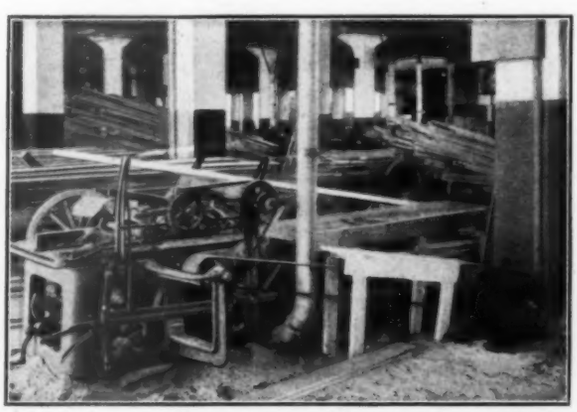
It is evident that on account of the nature and characteristics of the manufacturing processes the induction motor is the most suitable for woodworking plants.

When accelerating machines have great inertia to overcome, such as heavy planers and matchers, as well as machines equipped with flywheels, such machines should be driven with motors having high-resistance rotors; and the remainder, with squirrel-cage induction motors.

Practically all woodworking machines, with the exception of lathes for special work, run at constant speed. The sparking of the direct-current motor makes this type of motor usually undesirable for this sort of work. Lightweight, high-speed motors, involving lowest first cost, highest efficiency and power-factor are most desirable. The induction motor is well adapted for this purpose and its maintenance cost is somewhat less than for a direct-current motor. The squirrel-cage type of motor should be used whenever possible.

Mechanical Connection Between Motor and Machine.

Improper mechanical connection between motor and machine or motor and countershaft has in some instances caused unjust criticism of motor drive. For direct connection a flexible coupling should be used unless motor and machine are mounted on a common metal plate or the motor is attached to the frame of the machine. Most manufacturers of modern woodworking machines have so designed them that they can be readily adapted to individual motor drive. Chain drive or heavy belt with a spring belt-tightener is desirable when the motor must be located close to the machine, but cannot be direct connected. Flywheels should be used on motors driving machines which have only peak loads of short duration. With all belt drives a belt speed of from 4,000 to 5,000 feet per minute is most satisfactory and economical. Pulley ratios of more than five to one under ordinary conditions should be avoided when possible by using lower speed motors. When it is desirable to install a motor on a machine hav-



A 10-Horsepower Squirrel-Cage Induction Motor Driving Gang Rip Saw.

A 30-Horsepower Motor Direct-Connected to a Berlin Double Surfacer.

ing a speed several times greater than that of the motor, gear drives, using steel-cut gears and rawhide or cloth pinions have been successfully employed.

Individual Versus Group Drive.

As previously stated, individual motor drive is used throughout the plant of the Detroit Lumber Company's plant and has been found to admirably fulfill all predictions made for it. Of course, the relative values of group and individual drive must be determined in every instance by a careful analysis of the requirements of the installation. It is the consensus of competent opinion, however, that in a large majority of cases the highest efficiency, both for the machinery to be driven and for the electrical equipment, can best be obtained by the application of a separate motor to each unit.

There are other conditions that have an important bearing on the selection of drive for lumber mills that should be given due consideration. In modern establishments, high productive capacity will hinge largely upon the convenience and rapidity with which work may be handled. Therefore costly equipment may fail to realize possibilities unless the machines be installed with entire independence of the usual fixed line shaft conditions. In shops where productive machines are widely separated, one from another, or where occasional machines must be reached by long lines of shafting, individual drive is vastly more economical and generally preferable.

Elect Officers of Dallas Southwestern Traction Company.—Officers and directors of the Dallas Southwestern Traction Company were elected at a recent meeting of the stockholders of the company. E. P. Turner was re-elected president; E. L. Sargent, Sam P. Cochran and B. M. Sansom were made vice-presidents; John T. Witt was elected chief engineer, and J. E. Bassett, secretary and treasurer. The executive committee consists of J. J. Carter, Sam P. Cochran and John L. Cleveland.

LIST OF MOTORS WITH THEIR RESPECTIVE DRIVES IN PLANT OF DETROIT LUMBER COMPANY.

Description of Machine	Name of Maker	Capacity Per Minute	Speed of Heads RPM	Method of Drive	Motor		Remarks
					Size HP.	Speed RPM	
Matcher, No. 15, 6"x15"	Fay & Egan	30'- 60'	3200	Coupled	30	850	Heavy starting conditions
Matcher, No. 401, 6"x15"	Woods	125'-200'	3200	Coupled	50	850	Heavy starting conditions
Matcher, 6"x30"	Fay & Egan	30'- 60'	3200	Coupled	30	850	Heavy starting conditions
Matcher, No. 32, 6"x15"	American	30'- 60'	3200	Coupled	30	850	Heavy starting conditions
Profiler	Accessory to Woods, No. 401, Matcher			Coupled	15	1140	
Planer, 8"x30"	American	20'- 40'	3200	Belt	7½	1720	
Surfacer, No. 187, two 8"x10" surfaces	Berlin	30'-100'	3200	Coupled	35	1140	Heavy starting conditions
Single Surfacer, 7"x26"	American	20'- 60'	3200	Coupled	7½	1140	(Extended shaft motor)
Single Surfacer, 7"x30"	Buss	20'- 50'	3500	Belt	10	1720	
Outside Moulder	Fay & Egan	15'- 55'	3500 3400	Belt	10	1720	
Outside Moulder, 12" No. 22	Fay & Egan	15'- 55'	3500 3400	Belt	20	1720	
Outside Moulder, 6"	H. B. Smith Co.	15'- 40'	3400	Belted	10	1720	
Outside Moulder, 12"	Hermance	20'-100'	3400	Belted	30	1730	
Outside Moulder, 10"	Fay & Egan	20'- 65'	3400	Belted	15	1165	
Inside Moulder, No. 84, 10"	American	20'- 60'	3500	Belted	20	1720	Very heavy starting conditions. Requires wide motor belt.
Drum Sander, 3-drum, 42"	Smith			Belted	15	850	
Sander, 3-drum, 42"	Berlin			Belted	15	1165	
Belt Sander, 6"	Schimmel, Reid & Co.			Belted	2	1720	
Speed Changer, 66"	Moore & White	18'- 80'		Coupled	10	1140	
Rip Saw, self-feed, ¼ saws, 14" diameter	Hoosier	30'- 60'		Belt	15	1720	Rips 2" stock
Rip Saw, self-feed, ¼ saws, 14" diameter	Hoosier	30'- 60'	2600	Belt	10	1720	Rips 1" stock
Rip Saw, self-feeding	Greenlee	15'- 70'	2200	Belt	7½	1140	
Sizing Saw (2), 14" rip saws		60'	1720	Belt	15	1720	
Swing Saw, 18"			2200	Belt	2	1720	
Swing Saw, 16"	Buss		2600	Belt	2	1720	
Swing Saw (2), 12" to 18"			2200	Belt	5	1720	
Table Saw, 16"			2200	Belt	3	1720	
Table Saw, 16"			2200	Belt	3	1720	
Table Saw, 10"	Dodds		2600	Belt	2	1720	
Table Saw, 2-saw, 14"	Beach		2600	Belt	5	1720	
Table Rip Saw, 14"	American		2600 2600	Belt	5	1720	
Jig Saw, No. 47	Jones Superior			Belt	1½	1720	
Band Saw, 36"	American			Belt	2	1720	
Trim Saw, 12" diameter			2200	Belt	3	1720	
Resaw, 56" wheel, 24" boards	Mershon	18'- 60'	580	Coupled	25	580	
Timber Resaw 66" wheel feeds	Mershon	18'- 80' Timber—24"x21"x80'	480	Belt	40	1140	Heavy starting conditions
Window Frame—pocket machine	Smith & Phillips			Coupled	1	850	
Jointer, 16"	GreavesKlushman		3000	Belt	5	1720	
Jointer, 16"	Buss		3000	Belt	5	1720	
Single Spindle Borer				Belt	1	1720	
Double Spindle Shaper	Power & Co.			Belt	5	1720	
Shaper, single spindle				Belt	3	1720	
Timber Dresser, butts up to timber resaw, dresses two sides to 24"x24"x80'		18'	3000	Coupled	15	1140	
Hogg, No. 2C	Mitts & Merrill			Coupled	30	850	
Dowel Mortiser 4" boring bits	Dauber-Bell Machine Co.			Belt	5	1720	
Chain Mortiser	New Britain			Coupled	3	850	
Horizontal Mortiser, hollow chisel	Fay & Egan			Coupled	1	850	
Emery Grinder				Belt	1	1720	
Power Door Clamp				Belt	3	1720	
Single End Tenoner	H. B. Smith			Coupled	3	650	
Tenoner	F. B. Hayes			Belt	5	1720	
Sash Sticker	H. B. Smith			Belt	3	850	
Sash Sticker	H. B. Smith			Belt	3	1720	
Door Sticker	H. B. Smith			Belt	3	1720	
Exhaust Fan, No. 70, 60" diameter	Sturtevant		580	Coupled	35	850	

Load, Plant and Connected-Load Factors

A Graphic Analysis of the Common Factors With Actual Problems Showing Their Application

By TERRELL CROFT

This is the first of a series of three articles dealing in a practical way with load-factors, plant-factors and connected-load factors. The present installment discusses load-factors, operating-time load-factors and diversity-factors. Problems and their solution involving each factor are worked out and explained. The second article in the series will be published in an early issue.

THE load-factor of a machine, plant or system is (A. I. E. E. Standardization Rules, revised June 28, 1916, Section 55) "the ratio of the average power to the maximum power during a certain period of time. The average power is taken over a certain period of time, such as a day, a month or a year, and the maximum power is taken as the average over a short interval of the maximum load within that period. In each case the interval of maximum load and the period over which the average power is taken should be definitely specified, such as a 'half-hour monthly' load-factor. The proper interval and

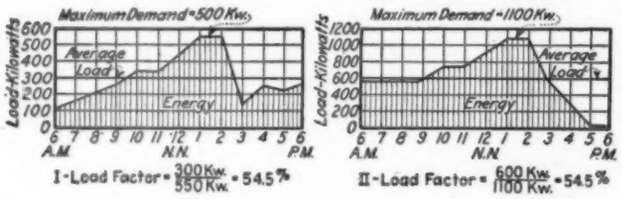


Fig. 1.—Two Graphs of 12-Hour Loads, the Load-Factor of Each of Which is 54.5 Per Cent.

period are usually dependent upon local conditions and upon the purpose for which the load-factor is to be used."

Load-factors are expressed as percentages. The "average power" may be either that generated or consumed, depending on whether the equipment under consideration is, respectively, (1) generating or delivering, or (2) receiving or consuming equipment. The "maximum power averaged over a short interval" is the maximum demand.

The term "half-hour monthly load-factor" means that the maximum demand is based on a half-hour time interval and the power load is averaged over a month.

The formulas for load-factor may, if the term "maximum demand," which is really implied, be substituted for "maximum power" in the above definition, be written thus:

(1) $$\text{Load-factor} = \frac{\text{average power}}{\text{maximum demand}}.$$

(2) Average power = (load-factor) × (maximum demand).

(3) $$\text{Maximum demand} = \frac{\text{average power}}{\text{load-factor}}.$$

Example.—In the central station serving a certain city of 8,000 inhabitants the peak load or 30-minute-interval maximum demand for the year 1915 was 580 kilowatts and the average power 232 kilowatts. What was the 30-minute, annual load-factor for that year? *Solution.*—Substituting in the above formula (1) load-factor = average power ÷ maximum demand = 232 ÷ 580 = 0.40 = 40 per cent. Hence, the 30-minute annual load-factor for this station was 40 per cent for the year 1915. Figs. 1 and 2 show other examples.

Example.—If a machine has imposed on it exactly the same power load during all of the 8,760 hours of a year, then obviously the average power load is equal to the maximum demand and then the annual load-factor for that year would be 100 per cent.

Example.—If a machine has imposed on it 1,000 kilowatts half of the time and no load at all the other half of the time, then the average load will be 500 kilowatts. The maximum load is 1,000 kilowatts. Hence, the load-factor is 500 ÷ 1,000 = 0.50 per cent. A load-factor of 50 per cent then implies that the equipment to which it relates is utilized to the extent of only half of its ability. It is obvious then that a load-factor denotes the percentage of the whole time which the equipment is operating at full load, it being assumed that the equipment is just capable of handling the maximum demand. Load-factors are used, principally, to determine the average power (or indirectly energy expenditure) of an installation when the maximum demand is known—or to obtain the maximum demand when the average power or energy consumption is known.

The period over which a load-factor should be reckoned will be determined by the circumstances of the case. Where an ordinary load, to be supplied by a central station, is involved, it is usual to consider only an annual or 8,760-hour load-factor —which is discussed in detail elsewhere. Where no period is specified, an annual load-factor is usually assumed. Since no-load costs in an electric generating station during any month or week are determined largely by the peak load expected during the month or week (G. I. Rhodes), it is evident that load-factors for a shorter period than a year should be used as a basis of power-plant-cost comparisons. Possibly the average daily, or weekly, load-factor provides the best value for such comparisons.

To compute the average power or the energy consumption over a given period of time the following formulas may be used. To calculate average power: divide the kilowatt-hours energy expended during the period by the number of hours in the period; the result will be the average power in kilowatts during the period. That is:

(4) $$\text{Average power} = \frac{\text{kilowatt-hours expended during period}}{\text{number of hours in period}}.$$

(5) and $$\text{number of hours in period} = \frac{\text{kilowatt-hours expended during period}}{\text{average power}}.$$

(6) Also kilowatt-hours expended during period = (average power) × (number hours in period).

Example.—Refer to Fig. 3. What was the average load on Generator G_1 which operated 5,545 hours during a year and

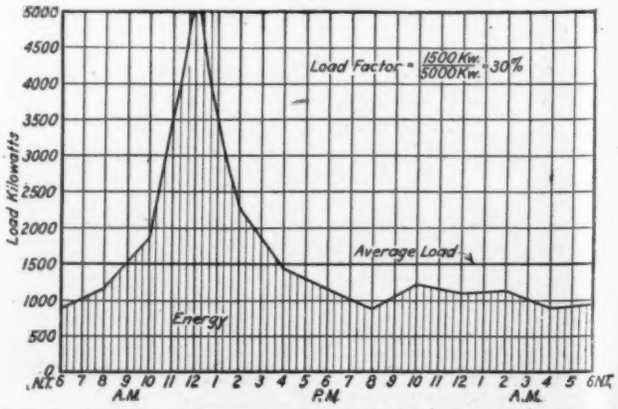


Fig. 2.—Load for an Average 24-Hour Working Day—Load-Factor is 30 Per Cent.

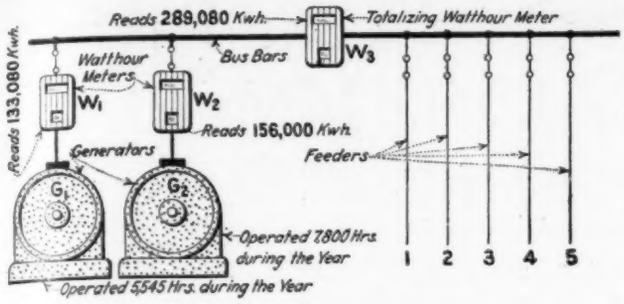


Fig. 3.—Examples in Determining Average Loads.

developed 133,080 kilowatt-hours of energy? *Solution.*—Average power=(kilowatt-hours expended during period)÷(number of hours in period)=133,080)÷5,545=24 kilowatts. Likewise, the average load on Generator G_2 was: 156,000 kilowatt-hours ÷7,800 hours=20 kilowatts.

Example.—What was the average load for the year on the generating station diagrammed in Fig. 3, which, as indicated by watt-hour meter W_3, supplied 289,080 kilowatt-hours of energy during the entire year of 8,760 hours? *Solution.*—Average power=(kilowatt-hours expended during period)÷(number of hours in period)=289,080÷8,760=33 kilowatts=average annual load.

Example.—The watt-hour meter at a certain industrial plant (Fig. 4) indicated during a certain year an annual consumption of 167,302 kilowatt-hours. What was the average load imposed by this plant during this year? *Solution.*—Average power=(kilowatt-hours expended during period)÷(number of hours in period)=167,302÷8,760=19.1 kilowatts. That is, the average annual load imposed was 19.1 kilowatts.

The relations so far explained were between average power and maximum demand. There are other important relations from which the load-factor may be computed. These relations depend upon the connected load and the ratio of the maximum demand to the connected load, or demand-factor. These two terms, "connected load" and "demand-factor" are defined as follows: "The connected load is the combined continuous rating of all the receiving apparatus on the consumer's premises connected to the system or part of system under consideration;" and "demand-factor is the ratio of the maximum demand of any system or part of system to the total connected load of the system or part of system under consideration."

The output ratings should, where feasible, be used instead of the input ratings.

Example.—The connected load on the service shown in Fig. 5 is: 2.5 kilowatts+30 kilowatts+13 kilowatts+7.5 kilowatts +5.5 kilowatts=58.5 kilowatts.

When the above relations are combined with those already given we have the following equations for solving load-factor problems on the basis of demand-factor and connected load where only one load is under consideration.

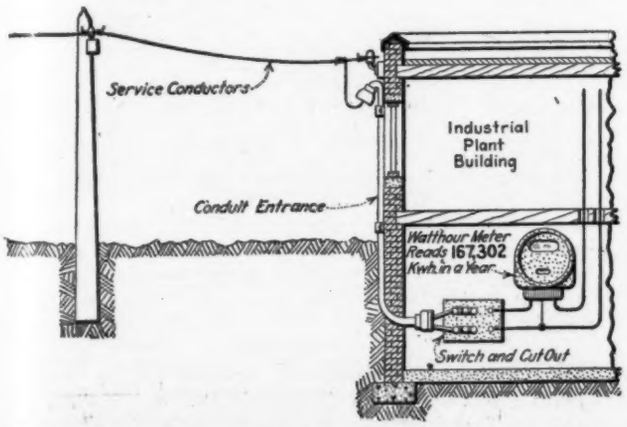


Fig. 4.—Determination of Average Load Imposed by an Industrial Plant.

Since maximum demand=(connected load)×(demand-factor), by substituting this expression in Formula (1) it follows that:

(7) Load-factor=
$$\frac{\text{average power}}{\text{maximum demand}}=\frac{\text{average power}}{(\text{demand-factor})\times(\text{connected load})}$$

(8) Average power=(demand-factor)×(connected load)×(load-factor).

(9) Maximum demand=
$$\frac{\text{average power}}{(\text{load-factor})\times(\text{connected load})}$$

(10) Connected load=
$$\frac{\text{average power}}{(\text{maximum demand})\times(\text{load-factor})}.$$

Example.—The connected load of a certain theater is 3.2 kilowatts. Its average power consumption during the year (8,760 hours) 1915 was 0.27 kilowatt-hours. If a demand-factor of 49 per cent be assumed as applying to this class of service, what was the annual load-factor for this installation? *Solution.*—Substituting in equation (7) load-factor=(average power)÷(demand-factor)×(connected load) we have,—0.27÷(0.49×3.2)=0.27÷1.57=0.172=17.2 per cent as the annual load-factor which may reasonably be expected for this class of service.

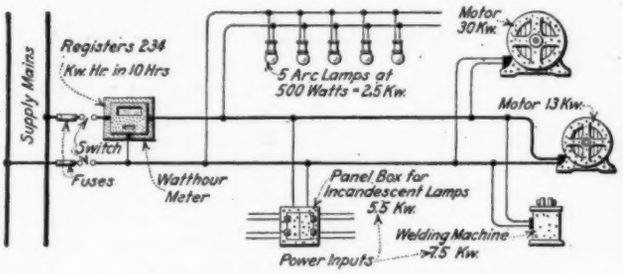


Fig. 5.—A Capacity-Factor Problem.

If several different loads or a group of loads are under consideration and there is a diversity among their demands, a diversity-factor may be introduced into the formulas.

By diversity-factor is meant the ratio of the sum of the separate maximum demands of the several connected loads in a group, to the maximum demand of the whole group considered as one system. The diversity-factor is never less than unity, but is usually greater. With this definition in mind we see that

Maximum demand=(connected load)×(demand-factor)÷(diversity-factor). Hence, substituting this expression for maximum demand in equation (1):

(11) Load-factor=
$$\frac{\text{average power}}{\text{maximum demand}}=\frac{(\text{average power})\times(\text{diversity-factor})}{(\text{connected load})\times(\text{demand-factor})}$$

(12) Connected load=
$$\frac{(\text{average power})\times(\text{diversity-factor})}{(\text{load-factor})\times(\text{demand-factor})}$$

(13) Demand-factor=
$$\frac{(\text{average power})\times(\text{diversity-factor})}{(\text{load-factor})\times(\text{connected load})}$$

(14) Average power=
$$\frac{(\text{load-factor})\times(\text{connected load})\times(\text{demand-factor})}{\text{diversity-factor}}$$

(15) Diversity-factor=
$$\frac{(\text{load-factor})\times(\text{connected load})\times(\text{demand-factor})}{\text{average power}}$$

Annual or yearly load-factor is equal to the average power load over the entire year divided by the maximum power de-

mand during that year. A year is taken as having: 365 days× 24 hours=8,760 hours.

Example.—What will be the probable annual load-factor (Fig. 6) of the load imposed at *A* by the five manufacturing plants shown, if the average load is 2.06 kilowatts? It is assumed that the demand-factor of their loads is 50 per cent and the diversity-factor between them is 1.44. *Solution.*—The total connected load is: 2.2+8.6+3.2+4.1+1.7=19.8 kilowatts. Then, substituting in equation (11): Load-factor=(average power)×(diversity-factor)÷(connected load)×(demand-factor)=(2.06×1.44)÷(19.8×0.5)=30 per cent. Hence, the load-factor of the combined installation is 30 per cent.

Examples of typical yearly load-factors for central station-loads are given by J. R. Cravath thus: A purely lighting load in a small town will yield at the supplying station a yearly or 8,760-hour load-factor of less than 20 per cent; in a large city it will be less than 25 per cent. By the addition of electric-motor and heating appliance loads, these load-factors have been improved (See Fig. 7) from year to year during the history of the central-station industry. A load-factor of between 30 and 35 per cent is now common in the smaller plants having a moderate power load. In some manufacturing cities, load-factors greater than 50 per cent have sometimes been attained, but such instances are rare. A combination of lighting, power and railway loads in a large city provides a load-factor between 40 and 45 per cent.

Operating load-factor is the ratio of the average power load imposed on a plant or by equipment, during the time which the plant or equipment operates to the maximum power demand imposed during that time. Frequently, central-station plants in small cities operate only during the night and industrial-plant generating stations may operate only during the day. Operating load-factors have their application for conditions such as these.

Example.—A certain small central station in a town of 750 inhabitants in Iowa operates 3,540 hours per year. The energy generated during the 3,540 hours of operation is 15,576 kilowatt-hours. The maximum power demand or maximum load is 16.9 kilowatts. (1) What is the annual load-factor? (2) What is the operating load-factor? *Solution.*—(1) The average power

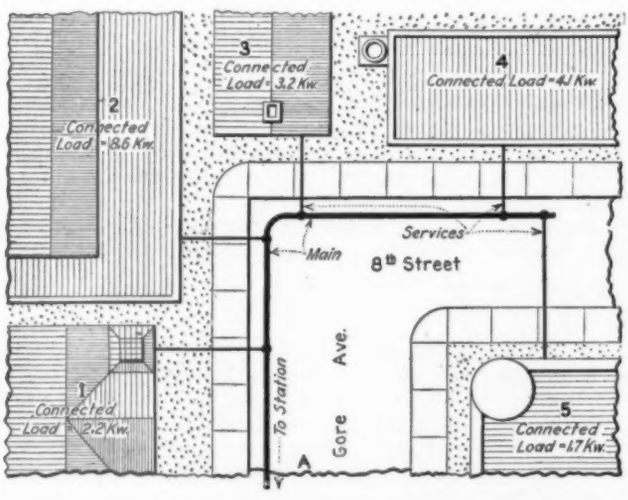


Fig. 6.—Example in Computing Load-Factor on the Basis of Connected Load, Demand-Factor and Diversity-Factor.

or load during operation is: 15,576 kilowatt-hours÷3,540 hours =4.4 kilowatts. Hence, operating load-factor=(average power load during operation)÷(maximum demand)=4.4÷16.9=0.26 =26 per cent. (2) The average load over the entire year is 15,576 kilowatt-hours÷8,760 hours=1.775 kilowatts. Hence, the annual load-factor=(average power load over entire year)÷(maximum demand)=1.775÷16.9=0.105=10.5 per cent.

(To be continued.)

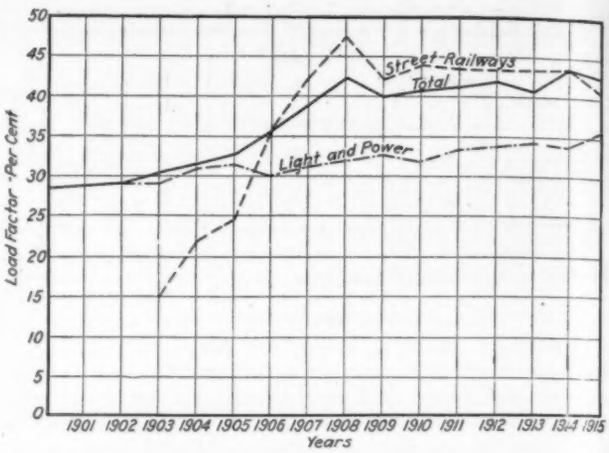


Fig. 7.—Curve Showing Annual Load-Factors of the Commonwealth Edison Company, Chicago—Indicating How Load-Factor May Be Improved by Consistent Effort.

Resistance of an Oil to Emulsification Shown by Laboratory Test.

When oil is used over and over again, as is the usual practice in large power plants, it may emulsify in a few days, if it is not good quality, and have to be thrown away, as it will not pass through the filters. In order to avoid the waste of time and great inconvenience of actually trying the oil in a turbine or other machine, a laboratory test has been devised by means of which it may be predicted whether or not the oil would give satisfaction in service. The test consists of violently stirring a small sample of the oil with water under standard conditions. Then the oil which will separate out from the water the most rapidly is the best oil for turbine lubrication, other things being equal. It is found that most of the oils on the market are either very bad or very good, and that there is no difficulty in finding turbine oils which will settle out from the water in a minute or less after stirring as above described. For some other purposes it is desirable that oils should emulsify readily, and the test shows that oils of this class, when subjected to the same treatment as the turbine oils, will not separate at all in one hour, nor completely separate in one year. When turbine oils are used for months or years, without renewal, they gradually deteriorate until they emulsify readily, even though they are very good oils to start with. The conditions of use in different plants are so different that it would be impossible to predict just how long a given oil would last, but it is believed that any power house engineer, by the use of this test, could keep track of the deterioration of his oil, and thus discover when it is time to clean out his lubricating system.

Details of this test are made the basis of Technologic Paper No. 86, issued by the Bureau of Standards, Washington, D. C. Winslow H. Herschell is the author.

Municipal Electric Plant Displaced by Central-Station Service.

The Minneapolis (Minn.) General Electric Company has closed contract with the city of Anoka, having an approximate population of 4,000, covering its electric light and power requirements amounting to 300 kilowatts. The city will discontinue operation of its municipal electric plant, but will continue the distribution and sale of electric current as heretofore.

Rate Hearing at Neenah.—A hearing will be held in Neenah, Wis., before the Wisconsin Railroad Commission within the next month, on the petition of the city of Neenah for a lower rate than is now paid the Wisconsin Traction, Light, Heat & Power Company for commercial lighting.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

Hang Tags on Every Door Knob in Washer Campaign.

The Salina Light, Power & Gas Company, of Salina, Kans., in conducting its campaign on electric washing machines, used an advertisement in the form of a Denison express tag calling attention to the merits of the electric. This was suspended from every door knob in town and good success was realized.

Exhibit of Springfield (Mo.) Gas & Electric Company Results in Many Cash Sales.

A great deal of interest was created by the many appliances which were on display at the booth of the Springfield (Mo.) Gas & Electric Company, the week of February 12-17, the occasion being the "Pure Food" and Industrial Show held under the auspices of the Traveling Men's Booster Association of Springfield.

Over 25,000 paid admission to the show which was held every afternoon and evening during the week. Several evenings people were turned away.

The booth of the company was decorated in black and white with pillars to match. The appliances being either nickel or black enameled finish blended with the surroundings. A big sign "Home of Gas & Electric Service" was placed over the main entrance and one "Cook With Gas or by Wire," appeared at one end of the booth. A large colored sign urging the advisability of tenants to move into a house wired for electric lights and informing the

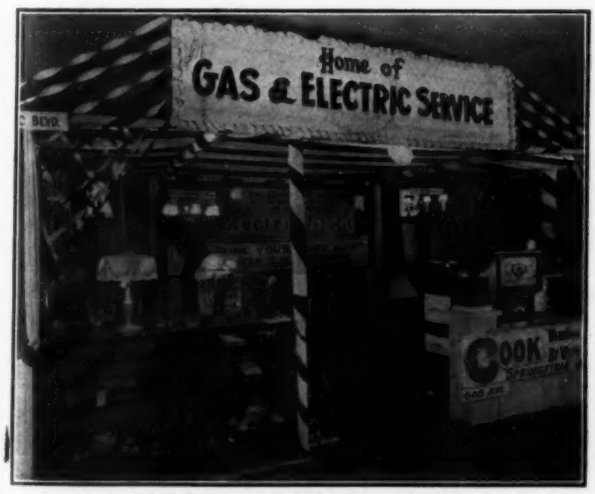


Exhibit of Springfield Gas & Electric Company Which Resulted in Many Cash Sales.

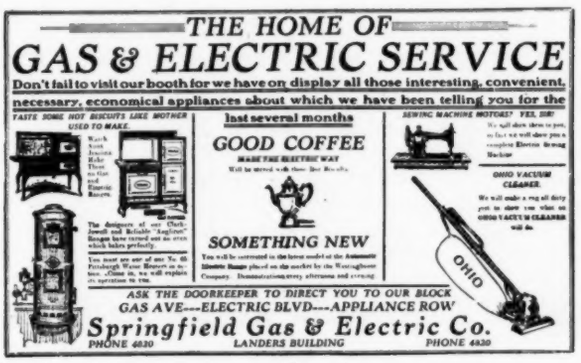
owner how he could wire his home and pay for it in 10 months placed at the back of the booth attracted a great deal of attention.

On all of the posts at the corners and at the entrance were set well shaped box tree plants which added materially to the home-like appearance of the booth.

The main street in front of the booth was called Electric Boulevard, and the other two streets were called Gas Avenue and Appliance Row, giving to this booth a distinctiveness not accorded others.

"Aunt Jennina" was on hand to bake and serve hot biscuits and electric percolated coffee. This was one of the most attractive features of the booth, and kept Aunt Jennina and her assistant working overtime. A Westinghouse automatic electric range was used.

The electric washing machine, vacuum cleaners and several sizes of power motors together with the sewing-machine motors and numerous heating devices in the show


THE HOME OF
GAS & ELECTRIC SERVICE
Don't fail to visit our booth for we have on display all those interesting, convenient, necessary, economical appliances about which we have been telling you for the last several months
GOOD COFFEE
SOMETHING NEW
OHIO
ASK THE DOORKEEPER TO DIRECT YOU TO OUR BLOCK
GAS AVE---ELECTRIC BLVD---APPLIANCE ROW
Springfield Gas & Electric Co.
PHONE 4030 LANDERS BUILDING PHONE 4030

Advertisement of Springfield Company During Show.

case were subject to a large amount of discussion by the visitors.

Several beautiful lamps were placed in the booth by one electrical contractor and the fixtures were loaned by another electrical contractor. A few 200-watt lamps hidden under the front part of the ceiling and directed to the rear of the booth made it bright as day and easily the best lighted booth at the show.

Special efforts were made during the show to give out every bit of information possible and to secure a good list of live prospects either for electric service or appliances. The sales that were made during the week more than covered the expenses incident to putting on the display.

Economy and Cost of Electric Cooking Shown.

Speaking recently before the British Association of Supervising Electricians, A. F. Berry, a pioneer in the electric-cooking field in England presented some interesting statistics showing the economy and advantages of electric cooking.

"A large number of individuals have sent in to me from time to time figures showing the savings effected by the introduction of electric cookers in their establishments. The majority of the figures relate to private houses, but some relate to canteen and school equipments. It is clear that the butchers' bills in private houses that used to be over $250 per annum are reduced to $200 per annum; that the weight of meat used in a term in a school of 100 is reduced in the ratio of 2,400 pounds to 1,950 pounds, when the older methods of cooking are discarded and electric cooking is fully employed," he said. "It will be seen that the retention of the old methods of cooking means that approximately 25 per cent more meat

is being purchased than need be. There is an economy also in making jam, marmalade, etc. I found, for instance, that the additional weight of marmalade when made on an electric hotplate instead of on the coal fire was of sufficient value to pay for the total cost of cooking anyway many times over.

"The question has been asked why considerable economy cannot be effected with every method of cooking. It can be if you have specialists to carry out the cooking. A specialist can crack an egg with a huge steam hammer, but everyone can do it with an egg spoon as well. It is not a question of what can be done, but rather of what is easily being done. It is particularly unfortunate that the waste of which we are speaking involves the waste of some of the most valuable properties; valuable in two ways—in the first place as actual nutriment easily assimilated, and in the second place as waste of delicate flavor, which helps so much to make food palatable and to promote assimilation of its goodness by the human system. It is a waste also in appearance of foods.

"My experience of the cost of many thousands of electrically-cooked meals—I should be more correct in saying hundreds of thousands of meals—leads me to say that you must expect that a good square meal will cost one-quarter of a kilowatt-hour per person—that is, for a number of people, in the case of schools, where one may take it that the meals served are the equivalent of two heavy ones daily, it has been found that rather less than one-half of a kilowatt-hour per day per person is required. In private houses, where the numbers are less and, perhaps, the meals more numerous, something like one kilowatt-hour per day per person will be required."

Electric Trucks Master Blizzard in New York City.

New York City, on February 5, 1917, experienced a very severe blizzard. A 50-mile gale accompanied the heavy snowfall, and traffic was badly affected throughout the city. Horse traffic was literally "snowed under."

The American Express Company, which operates 245 electric trucks and 259 gasoline trucks in the city, on this stormy day had 46 trouble calls from its motor trucks. Six of these calls were from electrics, and 40 were from disabled gasoline trucks. It was necessary to tow in two of the electric trucks, and 14 of the gas cars.

This creditable showing of the electric is only one of the good reasons why express companies are using electric trucks in large quantities. The almost absolute dependability of the electric truck puts it foremost in the handling of express, as well as in many other businesses requiring dependable transportation facilities. Comparative operating costs have proven the economy and efficiency of the electric in delivery work, and these are as great assets as its dependability. The electric commercial vehicle has made rapid strides during the last few years, and is becoming more and more a factor in city transportation.

Denver Company to Sell Stock to Its Customers.

Five hundred thousand dollars' worth of the new issue of $1,500,000 of six-per-cent preferred stock of the Denver Gas & Electric Light Company, which a syndicate is offering for sale, has been allotted to Denver. A letter addressed to all patrons in Denver has been sent out by W. J. Barker, vice-president of the Denver Gas & Electric Light Company, calling their attention to the investment. The purpose of this financing is to provide funds for the retirement of the bonds of the Lacombe Electric Light Company (a predecessor corporation) by their purchase in the market or call for redemption, and also to provide funds for improvements and extensions.

RESULTS OF A HOUSE-WIRING CAMPAIGN CONDUCTED THROUGHOUT THE YEAR.

Interesting Experiences of the Indiana & Michigan Electric Company at South Bend, Ind., and Suburban Towns.

The approach of spring is directing attention to special house-wiring campaigns, many of which will be undertaken in the next few months. There is a strong feeling among

INDIANA & MICHIGAN ELECTRIC COMPANY
WIRING CONTRACT

SPECIFICATIONS FOR WIRING AND FIXTURES

A Portion of Contract of Indiana & Michigan Electric Company Showing Space for Wiring Specifications.

many central stations that a concentrated effort in this direction for a month or two will bring greater returns than if spread out more or less over the year.

On the other hand, it is contended by those who favor a continuous and persistent campaign that no opportunity should be lost at any time in the year to secure the wiring of old houses and their connections to the lines. Conditions may be favorable in many cases for closing such contracts during the summer, fall or even winter months, which if not taken advantage of will mean an indefinite postponement or entire loss of the business.

This was the opinion of the executives of the Indiana & Michigan Electric Company, of South Bend, Ind., when, at the beginning of 1916, they instituted the plan of actively and continuously availing themselves of every opportunity to add customers to existing lines. Active competition with a local gas company and other special conditions made it advisable to lose no chances of adding not only old houses, but also new houses in which it was observed that no provision was being made for electric service It was found that a considerable number of houses were being erected that were piped for gas, but not wired. Consequently strict and persistent vigilance was necessary in order not to lose any business.

Among the means adopted to carry out this plan during the past year was occasional advertising in the local papers, advertising and suggestive hints on the electric light bills, a certain amount of direct-by-mail solicitation, several electric signs, but most important was the active solicitation of the business by a number of salesmen, averaging about six throughout the year. These salesmen were carefully picked for their work and certain of them worked continuously on old house-wiring business.

A few also worked on commercial lighting, power and other lines of new business.

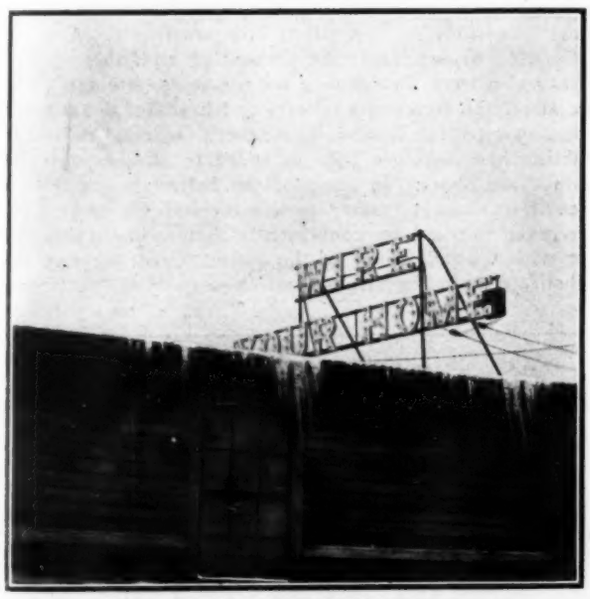
These men work on a combined salary and commission basis, since it has been found that the inducement of commissions for the actual business secured is a very powerful incentive to activity and effective work. In the accompanying table is given in condensed form a summary of the work of 11 of these salesmen. The column marked "amount received" gives the amount paid to the salesmen.

WORK OF HOUSE-WIRING SALESMEN IN 1916.

Salesman.	Months Worked.	Contracts Secured.	Amount Rec'v'd.	Cost per Connection.	Kilowatts Connected.	Cost per K.W. Connected..
A	12	160	$ 880.00	$5.50	64.0	$13.75
B	12	132	1,168.80	5.08	108.0	10.82
C	12	133	796.50	5.99	61.4	12.97
D	12	250	1,012.25	4.05	95.6	10.58
E	5	80	401.98	5.02	28.3	14.20
F	6	80	451.33	5.64	30.9	14.85
G	6	119	436.58	3.67	51.0	8.56
H	1	6	55.13	9.19	1.6	34.45
I	2	19	102.73	5.40	5.7	18.00
J	4½	57	281.38	4.94	19.3	14.57
K	2½	19	146.21	7.38	5.8	25.20
		*1055		†$5.75	*471.6	

A few salesmen were added when the campaign was begun. The plan was to divide the city into districts, each salesmen being given a particular territory for which he was responsible. The bulk of the work was by house-to-house visits. Careful record was kept by each salesman of his calls and of any features developed at each call that would lead to favorable results at any particular time in the future. The actual work of wiring was divided evenly among the six most reliable electrical contractors of the city whose co-operation was given very heartily.

Before the close of the year it was decided to extend the house-wiring campaign to two adjoining towns. On October 15 the work was undertaken in the village of New Buffalo and, after this town had been thoroughly worked, on December 1, the village of Galien was similarly campaigned. In New Buffalo there were secured 83 new



One of a Number of Electric Signs Used in Campaign.

connections and in Galien 91, making a total of 174 in these two towns before the close of the year.

In South Bend 850 houses and small stores were wired. Adding to this the number of other new connections secured through the efforts of the salesmen, there was a total of 1,076 secured through their efforts during the year. At the same time connections made directly through the office of the new-business department totaled 636. The total number of calls made by the salesmen during the year was 12,756; the average cost of each connection made by a salesman was $5.75; the average cost of each connection made, including all expenses of the new-business department, was $10.38; the average cost of each kilowatt connected was $12.75.

The average cost of each house wired was $41.78, of

FIGURING ON CHRISTMAS—
What better gift can you give your entire family than to have your home wired and give them modern illumination?

I. & M.

Bell 462. Home 5462.

A Newspaper Advertisement Used in Wiring Campaign.

which the wiring amounted to $20.94 and the fixtures $20.84. The average cost of wiring each room outlet was $2.62; the average cost of each room outlet, including fixtures therefor, was $5.25. The average number of room outlets per house was eight and the average load in watts connected per house was 400.

The fixtures were of 26 types, ranging from very simple single-light fixtures to cluster fixtures of more elaborate designs for the larger rooms and ranging from $1.55 to $12.65 in price. The wiring prices, which were found to be mutually satisfactory by the contractors and central station, and which were adhered to strictly throughout the campaign, were as follows:

UNIT WIRING COSTS.

Ceiling outlet	$1.65
Side outlet	1.70
Ceiling outlet with single-pole flush switch	3.90
Ceiling outlet or side with three-way flush switch	5.95
Ceiling outlet with single-pole cap switch	3.35
Ceiling outlet with three-way cap switch	5.25
Drop cord, $1.10; with canopy	1.20
Key wall socket	.80
Flush receptacle	3.00
Porcelain receptacle	.60

All of the fixtures were equipped with 25 or 40-watt lamps, except where other sizes were definitely specified. A charge of $2 was made for service connection for each house of less than five rooms. For houses having a flat roof and no attic a charge of $1 per room was added, on account of the increased cost of wiring under these conditions. Houses having double floors required an additional charge of $3 for the same reason. Small additional charges were also made for furnishing fixtures of greater than the standard length and for providing insulating joints where these were necessary. An inspection fee of five cents per outlet for the first 10 outlets and three cents per outlet for all in excess of 10 outlets was also made. Where a residence was constructed of brick the salesman was required to secure an estimate on the cost of the wiring from a contractor, since the foregoing schedule did not apply to brick or cement construction.

Along with its policy of turning over the wiring work to the contractors the company during the year also adopted the policy of turning over to local dealers the entire sale of appliances. Both of these policies were found to stimulate the active co-operation of the local contractors and dealers which is felt to be a very valuable asset in any undertaking of this kind. The cost of the wiring, as per the contract, was met by the central-station company when the work was completed, the contractor being paid in full. The customer had the privilege of paying the company either in monthly installments ranging up to 12 months or of paying in cash, for which a discount of five per cent was allowed.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

INSTALLATION OF INDIRECT LIGHTING FOR A LARGE BUSINESS HOUSE.

Effective Illumination Equipment Installed by a Progressive Electrical Contractor.

Step by step the engineers and designers of modern lighting appliances are gradually gaining ground and convincing thinking people that correctly designed and installed lighting is one of the best investments a progressive business house can purchase. Indirect lighting is not an entirely new thing in the sense that we understand newness, but still, owing to first costs in some cases and operating costs in other cases, many otherwise up-to-date concerns side-step this investment, and to their sorrow decide on installing some cheaper, but inferior system of lighting.

The latest addition to the ranks of those using indirect lighting is the Gordon Vantine-U. N. Roberts Company, of Davenport, Iowa. This concern makes a specialty of selling complete homes, something on the order of the average mail-order house. It has a complete office force fully equipped to estimate the costs of any average house, and to sell the entire equipment. This office force occupies a building four stories high, and covering a ground space of about 95 by 50 feet. This business, like a great many others, has been growing and expanding very rapidly during the past several years so that the original office building became too small for the company's needs.

During the summer of 1916 the owners enlarged their building and, while doing so, the question of re-arranging the lighting system became a very important one. E. C. Roberts, the vice-president of the company, who is very progressive in his ideas, made a special study of this feature and in connection with his investigations visited the plants of the Curtis Publishing Company, in Philadelphia; Armour & Company, in Chicago; and a number of other places where there had been installed indirect lighting systems. The more he investigated, the more he became convinced that an indirect lighting system properly installed was what he wanted. Mr. Roberts immediately began looking about for experienced and reliable contractors, and after some investigation employed the Electric Construction & Machinery Company, of Rock Island, Ill., to furnish specifications and install the system.

Indirect fixtures with mirrored-glass reflectors of the National X-Ray type were adopted, and the construction company, in connection with Mr. Roberts and the fixture makers, worked out the illumination on liberal lines. Just by way of comparison, Fig. 1 shows just how badly the firm needed a good lighting system. This picture was taken while the building was being remodeled, which accounts for the lath showing in the right-hand lower corner and also for the streaked appearance of the ceiling, but the lighting units shown were what they had been worrying along with for several years past. Further comment is unnecessary on this picture. Fig. 2 shows the same room after the building was completed. Fig. 3 is a picture of the drafting room. These two later pictures were taken at night and the exposure was 30 minutes in each case, no flashlight being used.

The first floor did not require any special study, as this was ordinary direct lighting. This is more of a large reception and talking room for meeting the customers and there is not much work of a close nature required in this room. The second and third stories are used by the different departments of the office force and the work done on these floors is the severest tax on any lighting system; it is all close work and there are a large number of employees working on blue prints constantly in the plan and estimating departments; the accounting and order departments also have their severe requirements, and the offices for all of the company's officers and heads of departments are also on these floors. The general scheme of indirect lighting has therefore been extended to all the offices on both these floors. In some of the hallways, coat rooms, etc., it was not necessary to use the indirect system and wherever it could be conveniently done without interfering with the uniformity of the system direct lighting was substituted. In the display and sales room on the second

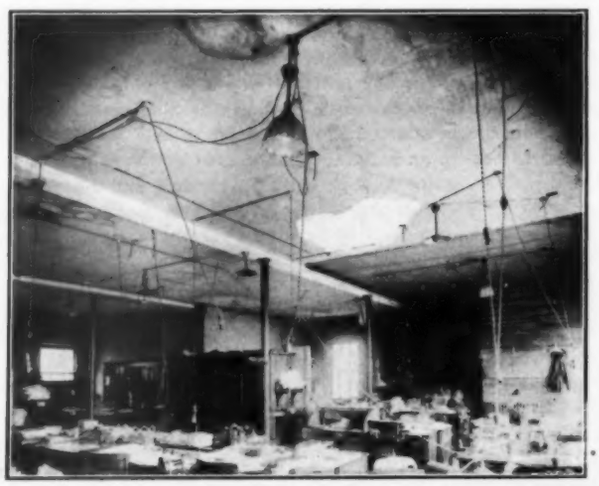


Fig. 1.—View in General Offices Showing Old Lighting Equipment in Use Before New System Was Installed.

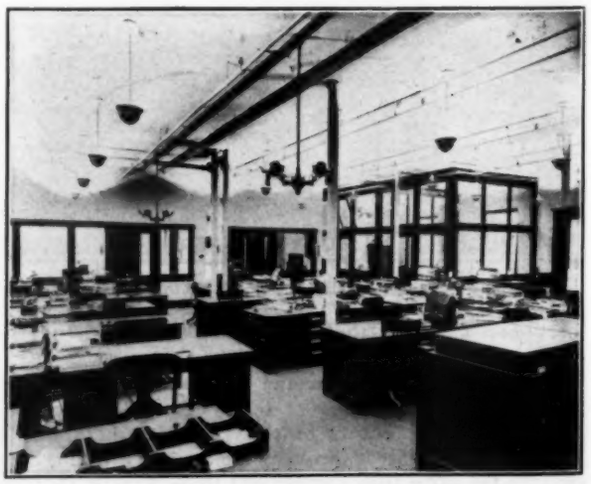


Fig. 2.—View in Same Room After Indirect Lighting System Was Installed and Building Remodeled.

floor, semi-indirect units were used for the psychological effect they might have on prospective customers. The drafting room is on the fourth floor; in it are employed from 20 to 50 draftsmen throughout the year, all at work requiring the best possible illumination.

In working out the details of this installation the owners and the engineers did not confine themselves alone to the

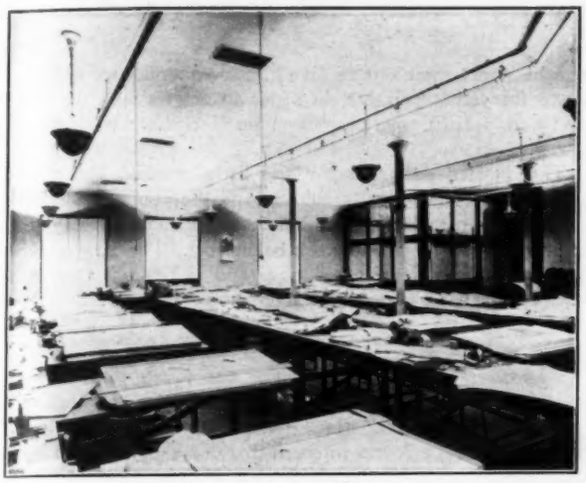


Fig. 3.—View in Drafting Room After New Lighting System Was Installed.

lighting units and to foot-candle intensities, but went further and made the decorative scheme conform and assist the lighting scheme. The ceilings were finished in light cream, merging on the side walls to a very mild green, all having a mat finish. The combined effect is all that could be desired and makes a very pleasing combination.

After the installation was completed, readings were taken with a Sharp-Millar photometer on the different floors, and the following table shows the result of these readings.

Location—	Foot-Candles	Volts at Panels
Fourth Floor.		
Mr. Ross' room	3.3	112
Drafting room	6.3	111
Addressograph room	3.75	114
Typists' room	3.5	116
Card file room (N. E.)	3.32	113
Card file room (S. W.)	7.1	113
Mr. Kretzler's room	2.6	113
Multigraph room	3.9	113.5
Third Floor.		
Adjusting department	5.8	111
Mr. Clausen's room	3.78	111
Mr. Nelson's room	3.85	110
Mr. H. G. Roberts' room	5.0	110
Ante rooms	3.7	109
Mr. E. C. Roberts' room	5.1	112
Mr. Scott's room	4.5	111
Mr. Schick's room	7.0*	111½
Second Floor.		
Plan department	6.15	109
Estimating department	5.1	110
Mr. H. B. Nelson's room	3.78	111
Mr. Spelletick's room	4.0	111

*This high reading probably due to illimination from surrounding rooms.

It will be noted that the line voltage varies considerably and while this does not make any marked difference in a practical sense with an indirect system, yet as a matter of comparison it would be desirable to reduce all readings to a standard of 110 volts. Regarding the test readings themselves, the schedule shows that in all cases throughout the building the illumination is ample. In Mr. Kretzler's room the lowest intensity was observed, but he still has a good working illumination for his general requirements.

Every feature of the installation has been found very satisfactory to the owners of the establishment and to their employees. Customers also have remarked on the excellent lighting now obtained.

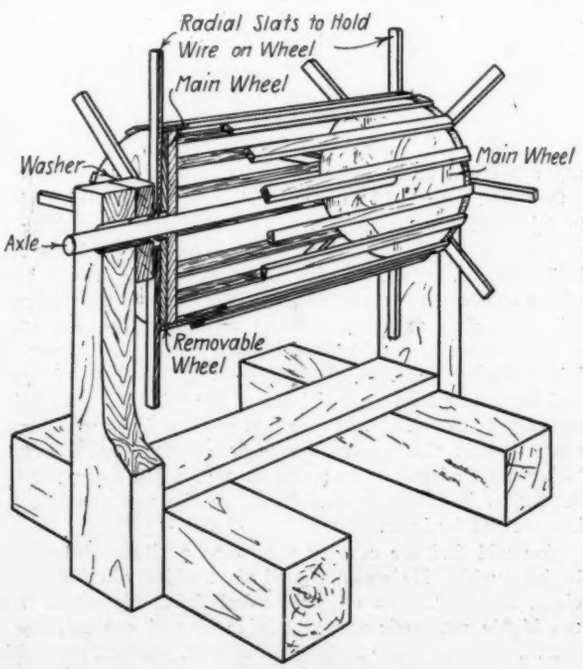
Reel for Use in Pulling Several Wires Into Conduit.

By Frank Boone.

We formerly had a great deal of trouble in pulling wires into conduit, especially when pulling in 3, 4, 5 or more wires. Unless the wires can be cut off before they are pulled in, they are inclined to tangle badly. To overcome this trouble I made a reel that solves the problem very well.

Two wheels are first made from about one-inch board and turned to about 10 inches in diameter. Bore a 1.125-inch hole through the center of each. Nail slats on the edges of the wheels about two inches apart so as to form a sort of squirrel-cage cylinder. For my reel I made these slats 18 inches long. These slats should project over the edge of one wheel one inch and be flush with the edge of the other wheel. On the face of this latter end wheel nail radial slats or spokes, at least six and eight will be better; these are to keep the wire from slipping off. Now cut another wheel like the two already mentioned, but not necessarily as thick. On one face of this nail radial slats to correspond to the ones on the flush end of the squirrel cage. A frame is made from 2 by 4's, but the base blocks should be quite heavy to weight the whole reel properly and keep it from tipping over when the wires are pulled. The accompanying sketch shows the general arrangement, one end being partly broken away to show the detail. A piece of three-fourths-inch conduit will serve as axle. A block or thick washer should be nailed inside the frame.

In using the reel it is bodily taken from the frame and the frame and the removable wheel slipped off. Now the bundle of wire to be used is split and half of it turned around, then the whole bundle is slipped over the reel at the end where there are no spokes. If more than two wires are to be pulled in, other bundles are put on the reel as may be necessary. The removable wheel is again put on, its spokes closing the free end and the projecting longitudinal slats fitting in between these spokes to keep the wire from getting between the two adjoining wheels. Now the reel is put back in the frame and the wires are ready to be pulled. By turning half of each wire bundle around before putting on the reel, it is possible to pull wire in the same direction from each half of the bundle and this without tangling. Use of this or a similar reel also avoids wasting both time and wire which is so common when the wires must first be cut to approximate length.



Simple Reel for Use in Pulling Several Wires Into Conduit.

Value of Farm Business to Contractors

Why the Electrical Contractor Should Interest Himself Promptly in the Sale and Installation of Farm Lighting Plants—Neglect Means the Loss of a Profitable and Non-Competitive Business

By GEORGE W. HILL

MR. ELECTRICAL Contractor: What are you going to do about the country electrical business? Are you going to sit idly by and see another branch of your business swallowed up by some other industry, or are you going to line up and fight like a real soldier?

The time is ripe for you to give the country electrical business due consideration. This business rightfully belongs to you just as much as does the city business and the writer believes that if you are to do the country electric business surrounding you it behooves you to get busy and get into the game without further delay.

It will be necessary for you to secure the agency for some good plant and do your part in helping to educate the country gentleman to the use of electricity for light and power and to establish yourself in the trade in such a strong way that others cannot route you from the position which you should hold in a business which you have spent much money and energy to bring it to its present state of perfection.

The electrical contracting business is naturally a fighting game from start to finish and I am sure that I am sounding no new notes to those who have been in the business for any length of time, if I should say that the legitimate electrical contractor has been compelled to fight for every inch of ground he may have gained and the fight is now on for the country business.

Don't Be Caught Napping.

Don't let it be said that the implement, hardware and other dealers have caught you napping and have taken away from you another branch of the industry. It has in the past been altogether too easy for men to enter the electrical contracting business and then to barely make a living. It may be said that where nature has been most lavish men have been most lazy and where a man could stretch his arm and grasp a square meal there is no incentive to stretch the mind and grasp an idea or a principle.

You electrical contractors who do not grasp the idea of entering the country electrical business will wake up some bright morning and find to your surprise that others have become so thoroughly entrenched in this industry that you will find it difficult to break through the barbed-wire entanglements, and much will be lost.

One contractor said to me: "Oh, what's the use? I have to drive out into the country and sell the plant, then drive out with the men and material, and then drive out and bring them in." But my answer to him was that he could much better afford to spend his time driving in the country than to spend this same time and money in an attempt to learn what his competitor or competitors were going to bid on this or that job, while, as a matter of fact, the very life blood of profit had long since been squeezed out of the job before he had an opportunity to bid. I told him that perhaps, if he would spend more time in the country, he might miss the opportunity of losing a lot of money in trying to take a job away from his competitor just because he did not like him and wanted to run him out of business.

You will find the country gentleman a pleasant man to do business with. He wants a good plant which will furnish him clean, healthful, cheerful, economical light, one which is not too highly automatic and that is easily and conveniently operated. In short he is looking for a good, practical proposition. He wants a good job of wiring, and a good set of fixtures, and he wants some one to give him some assistance and advice as to the plant operation, in order to get for him the longest and best possible service. Then he is entirely willing to pay for it.

The farmer doesn't know the little crooked kinks, which the general contractors, architects and the public generally use to induce you to lower your bid in order that they may secure their electrical goods and work below cost. The farmer doesn't know anything about these things and if he finds them out it will be because you teach them to him.

Country Business Comparatively Profitable.

I know in any number of cities and towns throughout the country where wiring is done even in the face of high prices for $1 per outlet and flush switches installed for 75 cents. Usually it will be found where such ridiculously low prices prevail that the contractor is letting his competitors or customers set his prices or that he does not know his costs and is unable to set an intelligent selling price. On the same class of work $2.50 per outlet and $1.00 for flush switches are being secured in the country with an addition of $10.00 to the whole figure to cover incidentals. In my opinion it is more or less a lack of energy on the part of many electrical contractors, who think it is too much trouble to go out and get acquainted with the farmer.

Let me tell you, Mr. Contractor, to go out among the farmers in your country with the intention of treating them right, and remembering at all times that the farmer is well posted on farm lighting plants, storage batteries, etc. Talk with him in his own language, show him that an electric light plant will better living conditions and pay for itself. Show him that he can produce electric current much cheaper than most of his city brothers can buy it for, that a bright and cheerful home will have a tendency to keep his family on the farm, that it reduces the accident and fire hazard and makes a two-handed man of him when he is doing his chores, instead of a one-handed man with a risky lantern. Give him to understand that you are surrounding him with an organization which is anxious to make each customer a satisfied one.

In short, convince him that you are going to treat him right in every particular and you will find that it is not so much a question of price as a question of your Q. Q. M. (Quality, Quantity and Mode of conduct, the ruling power of all successful business undertaking). If your Q. Q. M. is all right, you will find the farmer a willing servant and he will speak a good word to his neighbors and will in a large measure pay you back in profits in future sales for every service you render him.

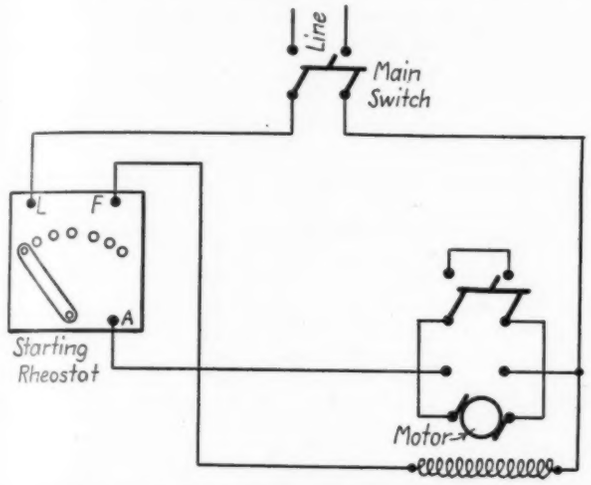
What Has Been and Can Be Accomplished.

In order to give you some idea of the amount of business which is being done in the country, I will say that S. Matson, of Davenport, Iowa, sold eight plants with wiring and fixture jobs in one week; C. E. Walters, of Ottumwa, Iowa, sold 11 in one week; the Electric Construction & Machinery Company, of Rock Island, Ill., sold from May 1 to October 27, 1916, a total of 62 farm lighting plants. There were more than 60 farm lighting plants of one make sold in Scott County, Iowa, in six months last year, and there are men now selling from three to ten plants per week and it is safe to say that in 90 per cent of the cases there is absolutely no competition on the wiring jobs.

Simple Dynamic Brake for Motor.

By James D. Lynett.

Recently I had a job to install a 10-horsepower, direct-current shunt-wound motor. It was to drive a large boring mill through a belt drive. A few weeks after the installation was completed I was sent for by the chief machinist of the shop. He complained that when the motor switch was pulled out the motor continued to turn over for quite a while, which of course also turned the



Simple Circuit for Dynamic Braking of Shunt Motor.

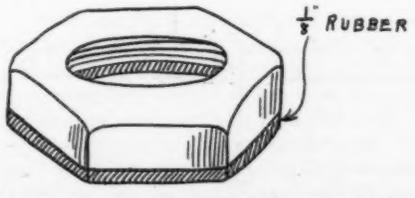
driven machine, and as a rule the machine stopped just in the place where he didn't want it to. It was then a case of throwing in the switch again and moving the rheostat handle to the first notch to start up the motor and releasing it again. This action burnt the rheostat contacts and was also very unhandy for the operator of the machine.

After thinking it over for some time I connected up a double-pole, double-throw switch in the circuit, as shown in the sketch. When the operator wanted to shut down the machine and have it stop at a certain place he pulled the motor switch and threw over the double-throw switch onto the short-circuiting side, which short-circuited the armature and the motor then came to a stop in a much shorter time than before. This proved to be very satisfactory and is still operating every day. This scheme can also be used for many cases where it is desired to stop a motor short without doing any damage to the motor. If the main motor switch should be again closed while the armature-short-circuiting switch still remained closed, of course the line fuses will blow. To avoid this, it is desirable to provide some interlock so that the main switch cannot be closed till the armature switch is again thrown over.

Applying Water As Lubricant in Drilling Marble.

By H. B. Stillman.

The usual method of applying water to the drill, when drilling marble, is to apply the water with an ordinary machinst's



Nut with Rubber Gasket to Hold Water in Drilling.

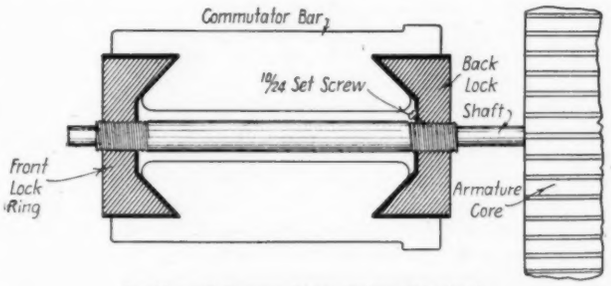
oil can. The writer finds it a very good plan to take a large-size nut, with a hole about one and one-fourth or one and one-half-inch in diameter, stick a piece of one-eighth-inch sheet rubber to the bottom of the nut with shellac and trim off the edges and inside the hole. Of course, if a rubber gasket of the right size is handy, use it. After the rubber has become set, it is put around the hole to be drilled and makes an excellent method of keeping a constant supply of water at the drill. The hole in the marble should first be drilled just deep enough to center the drill properly. Place the nut around the hole and fill the hole with water. Any openings or cracks around the rubber soon become filled up with marble dust, and the nut will usually hold water enough until the hole is drilled through. *Never use oil in drilling marble,* because you will nearly suffer nervous prostration in removing the stain.

Repairing Motor Commutators.

By Elmer Butcher.

I have found that Crocker-Wheeler commutators have to be removed from the shaft in order to refill and tighten them properly. Both the front and back lock rings screw on the shaft and tighten with right-hand threads.

First countersink a hole in the face of the front lock ring about one-quarter inch, then with a hammer and punch give it a few licks to unscrew it. Unsolder enough bars and slip them out to leave room for the drill and tap. After a set screw is put into the back shell to lock it on the shaft it is ready to be repaired without pulling the shell off of the shaft. This saves unsoldering all of the leads which may damage the insulation in reconnect-



Section of Commutator Being Repaired.

ing. The set screw keeps the back lock ring from unscrewing when the front lock ring is tightened.

I believe armature repairmen who are in the habit of refilling commutators with the leads connected will find that this plan will save them a few hours on each job.

Among the Contractors.

Frazer & Morrell, contractors, who were awarded the contract for lighting Woodland Park at Lexington, Ky., have received the materials and begun construction. All of the feed wires will be laid in conduits.

The Watson Flagg Engineering Company, 27 Thames Street, New York, has been awarded a contract for electric light and power wiring in the new clubhouse to be erected by Joseph Jewkes & Sons Company for the Carteret Club, Boulevard and Duncan Avenue, Jersey City, N. J.

Russell & Company, electrical contractors at 56 West Forty-fifth Street, New York, N. Y., have been awarded the contract for the electrical work in connection with the large residence of A. R. Kuser, Bernardsville, N. J. The house is 44 by 156 feet and has a wing 32 by 72 feet. The work includes rigid conduit and slate panelboards throughout; a system of call bells and electric reset annunciators; conduits for telephone wires and electric-heating equipment in all of the bath rooms.

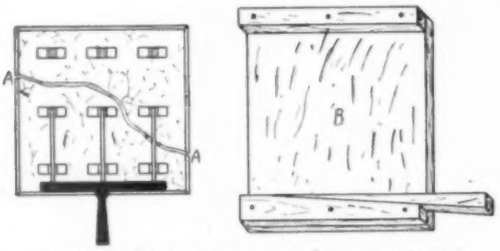
DOLLAR WIRING KINKS

All readers are invited to contribute to this department. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; if a diagram is necessary, a rough pencil drawing will serve. The idea itself must be new and bright. A dollar will be sent to the contributor upon publication.

Repairing Slate Base for Switch.

Having occasion to mend the slate base of a three-pole knife switch, I pursued the following method which gave very good success. The break was across the base, as shown at *AA*, and as the slate was but one-half inch thick and needed to be repaired at once, I made the form *B* shown at the right side of the sketch.

Form *B* is nothing more than a seven-eighths-inch pine board, with a cleat screwed on each end, one being straight



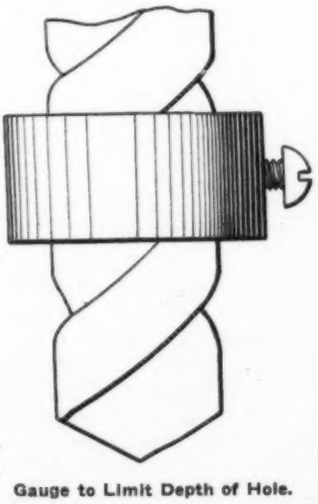
Good Method of Repairing Slate Base for Switch.

as shown and the other being tapered, with corresponding wedge to make the necessary clamping effect. Had I used ordinary clamps, the switch would have sprung up in the middle.

After smearing the edges of the break with a cement called "liquid glass," I laid it, bottom down, on the form and laid weights on top. I then drove home the wedge. After leaving it stand for about eight hours, I loosened the wedge and found a perfectly tight and strong joint at *A*. The switch was immediately screwed back in place and is apparently as good as ever. Robert G. Altona.

Drilling in Slate or Other Materials to a Definite Depth.

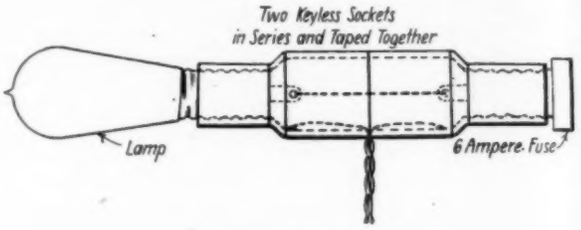
Where there are a number of holes to be drilled to a certain depth in slate or marble, use a collar or sleeve made from any odd piece of brass or copper rod, drilled the same size as the hole to be drilled in the slate. Drill and tap a hole in the side of the collar for a set screw. This collar may easily be adjusted to permit drilling to the necessary depths. If the set screw is securely tightened it will insure having all the holes of a uniform depth. This is especially important where the pole has to be quite deep but must not go clear through the slab. Although I have used this scheme only for slate and marble, I believe it should prove equally useful in drilling slabs, plates or boards of other materials. H. B. Stillman.



Gauge to Limit Depth of Hole.

Simple and Handy Test Outfit.

A very handy device for an electrician to carry in his tool bag is a simple test outfit, made out of two old keyless sockets. Take off the two caps and connect the sockets in series, leaving a length of lamp cord hanging from the



Useful Testing Outfit.

other two binding screws. To test for 110 volts use a lamp in one end and a six-ampere fuse in the other. To test for 220 volts, put a lamp in each end. This makes a neat outfit for either 110 or 220 volts. Walter Morris.

To Keep Transformer Cables from Siphoning Oil.

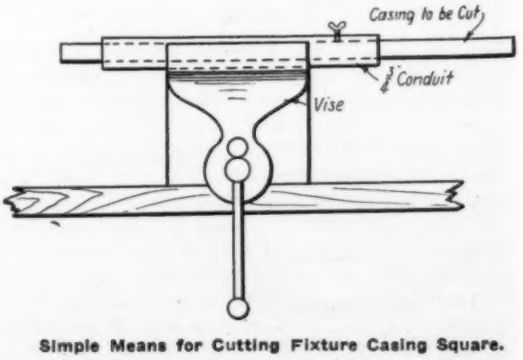
Transformer oil is frequently sucked up through capillary action by the braiding on the connecting cables and siphoned over the sides of the transformer case. To prevent this, I cut back one inch of the cable insulation above the surface of the oil and with a squirt gun fill the insulation with glycerine for a few inches. This chokes up the pores in the braid and any crevices in the cable make-up, thus completely preventing the siphoning trouble.

J. B. Reid.

To Cut Fixture Casing Exactly Square.

Much time can be saved in fixture work that now is wasted in efforts to overcome irregular ends of fixture casing. The device illustrated herewith will permit casing to be cut perfectly square so that the fixture can be assembled quickly without a lot of filing or other fitting. Take a piece of three-quarter-inch conduit and square up the end so it is exactly at right angles to the sides. Put a thumb screw in it about two inches from the open end and insert the conduit in the vise. The casing is put inside the conduit so as to project the exact distance to be cut off. The thumb screw is then tightened and the casing cut off by letting the hack saw follow the squared face of the conduit, thus producing a perfect cut in very little time.

E. M. Raetz.



Simple Means for Cutting Fixture Casing Square.

DEALER AND STOREKEEPER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Storekeeping for the Dealer in Electrical Appliances

LOOKING FORWARD TO SUMMER BUSINESS.

Suggestions for Increasing Fan Sales, Attracting People to the Store and Displaying and Demonstrating Seasonable Goods.

By Ira R. Alexander.

Mr. Electrical Merchandise Dealer, you know that during the summer months your business tends to let down to a considerable extent. Why not cast about you for ideas that will help hold your summer trade up just as high as possible? There are plans that, if successfully carried out, will do this. Every once in a while we hear of dealers in different parts of the country that report that their summer business is helped by conducting certain campaigns and selling plans in the summer months that aid in enlivening business at their stores. Now it is a good plan to consider the wherefore of their schemes; add similar and original points to fit your own situation, and do a bigger business this summer than you have ever done before. Thus in looking toward the summer months with that idea in mind, several sales aids that have been successfully used during the summer months by dealers in different parts of the country, and which the writer knows were successful, are given in this article with the knowledge that if they are used they will enliven business at any store dealing in electrical merchandise.

The electric fan always comes in for a good sale during the hot weather, but are you getting as many fan sales as you should? The fan is a good article to push in the summer months, but in pushing the sale of it let the people know what it is good for. Many dealers are in the habit of displaying their electrical fans in their store and windows, and mentioning in their newspaper advertising that they have fans for sale, but that is about as far as they go. Do more than that. Create a market for the fan that has never before been fully developed in your city. Educate the people to the fact that the fan can be made to serve a good many purposes besides keeping rooms cool.

It is a good plan to show the housewife the many home uses of the electric fan, for in doing so you are enlarging your fan field and thereby increasing your sales of that article. Tell the housewife she can use the electric fan in aiding her weekly washing. After the washing is returned from the laundry it should be hung where the fan can "blow" on it. Any dampness remaining after drying and ironing at the laundry is removed, any odor of soap is destroyed, and a fresh sweetness imparted to the linen. Fine laces and linens preserve their whiteness better if dried by the fresh air. Use these points in advertising, sales talks and the like in pushing the sale of the electric fan this summer. It would also be a good idea to fit up a window display showing the fan drying a line full of clothes.

Also feature the fact that the fan aids in drying paint on a floor or in other parts of a room; tell of its use in the sick room where it aids in supplying fresh air; how dust does not accumulate where there is a free circulation of air; how women can use a fan to dry their hair after a shampoo; etc. There are many, many other uses to which the electric fan can be put to in the home today and these facts should be studied out and used in increasing the sale of the fan.

One Western dealer printed a little book describing a large number of uses for the fan. The title of the book was, "101 Places You Can Find Mr. Electric Fan." Each week he featured a different use for the electric fan in one of the windows of his store, and by giving away the little book describing the uses of the fan, he did a very big business all during the summer months in the fan department of his store. It did not end there either, for many of the uses for the fan mentioned in the book could be utilized all during the year and so his fan sales extended past the summer months.

The Baty Electric Company, of Colorado Springs, Colo., at one time featured a contest that served to draw a large number of people to its store and thereby increase its business. A large oil painting, a reproduction from one by William Thorne, was displayed in the salesroom of the concern. Prizes amounting to $250 were offered for the best suggestions for the missing title of the painting. The fact that the picture was displayed inside the store meant that those wishing to see it and supply the title had to come into the store to do so. This fact drew a large number of people who had never visited the store before and many of these became customers. The contest also served to bring people into the store who merely wished to suggest a title and get in line for the prizes, but even though they came with no thought of buying, many saw on entering the store articles they were in need of and so business was increased directly, as well as indirectly, as a result of the contest.

The above example illustrates the fact that a good, and well conducted, contest is a mighty good thing to enliven business. Therefore, Mr. Dealer, why not get busy and plan a business-drawing contest to be made use of this summer? It will aid in holding up your summer trade.

Summer is also a good time to push the sale of electric cooking devices. Fit up a booth in your store and demonstrate a different kind of cooking device each week on certain days at certain hours. Invite the ladies to these demonstrations and serve them with coffee and cake and other eatables prepared on the electric cooking devices. Have attractive descriptive literature prepared to give them when they visit your store, telling about your line of electric cooking devices.

Get up a good electric washing-machine window and tell the housewives in that and other advertising ways the value of owning an electric washer. Show them how the drudgery of washing on hot days is done away with.

Last summer a dealer gave away tickets to an amusement park, with every purchase amounting to such a sum, with good results. Live dealers can put a suggestion of this kind to many and varied uses—all of which will increase summer business.

In fact, there are hundreds of ways of increasing summer sales and it is well worth while to spend a little time now and map out your summer selling campaign. Don't be satisfied with conducting a contest that lasts a week or two, or in getting up a good window display once in a while; but get down to business and be on the lookout for things that will keep your business enlivened all during the summer. Every time an idea occurs to you write it down and make use of it when the hot weather comes around.

Business Hints for Electrical Dealers

Lighting the Show Window—Getting the Neighborhood Business—Looking Toward the Future—A Preachment on Preparedness—Fans in First-Aid Work—Reducing the Overhead

By G. D. CRAIN, Jr.

A CERTAIN electrical store in Chicago is located on the first floor of a large office building. The latter is not in the congested district, but even at that the traffic is considerable, independent of that due to the office building itself, which is heavy. From 4:30 until 7 o'clock, the store is passed by hundreds of people leaving the office structure.

The electrical dealer keeps his store open from 8 until 6 p. m., and when he quits, he not only locks up, but turns out the lights. He carries a good stock, consisting of all the up-to-date appliances that people are interested in nowadays, but a good many possible buyers don't get much of a chance to see the goods, because the store is dark when they pass by.

For example, a window display in this store attracted the attention of one of the tenants of the office building, just as he was leaving shortly after 6 o'clock. He saw an electric iron in the window, and recalled that his wife had been saying how much she would like to have one. So he stopped to take a look at those on display, and to learn the prices. But just as he started to look them over, out went the lights, including those which lighted the window. The electrical dealer was quitting for the day, and so the prospective customer walked on. Maybe he will think of irons again, but at least one opportunity to make a sale was lost.

This dealer, if asked about the question, would doubtless explain that the traffic passing his store in the evening is too small to bother about, and that he doesn't want to have to make special arrangements about turning off the lights after a certain hour. This sounds reasonable, but the fact remains that he is overlooking selling opportunities, and incidentally advertising his store in the wrong way by failing to have at least his windows illuminated in the evening hours.

Getting the Neighborhood Business.

Electrical dealers in suburbs, who see business going by their establishments to the bigger stores down-town, may be interested in some remarks made not long ago by the head of a prosperous little bank in a suburb, who has managed to build business and to interest those in his district in patronizing the home institution.

"In order to win the support of your own locality," he said, "you have got to support that locality. That is to say, it's largely a reciprocal proposition. It may sound narrow and petty to say, 'You scratch my back and I'll scratch yours,' but self-interest dominates a great many transactions in this world of ours, and it's a good policy to play to it.

"I have made my bank a factor in the community life of this suburb. We advertise in the local paper. We give to the various neighborhood charities. I personally take an active part in boosting, through the organization which is working along civic and commercial lines. The bank has been made a place of meeting for many committees and small bodies.

"Furthermore, we buy as much as we can from the people who are out here in the suburb. The local printer gets our business—not one miles off, even though the latter may quote a lower price. The nearest coal dealer is patronized, and we make a point of buying from one who is in business for himself, and not operating a 'line' yard, controlled somewhere else.

"Putting it briefly, we make ourselves known and esteemed by everybody in the suburb. We let them know that we want their business—and we get it."

The electrical dealer who is anxious for local trade and yet knows hardly half a dozen people in his neighorhood or suburb, ought to take some of these things to heart. He can readily adapt the idea to his own work, and get in touch with those who have business to be attended to.

Looking Toward the Future.

"I envy you your opportunity in getting help!" said a druggist to a friend who is in the electrical business.

"What do you mean?" asked the latter, somewhat puzzled, for he did not know that he possessed any particularly good opportunity along this line.

"Why, you have a business that boys like," said the druggist. "The youngsters like the automobile, motion-picture, sporting goods and electrical lines better than any others. They are all attractive in and of themselves, while my trade doesn't seem to appeal. Besides, the hours are long. Consequently, we have a hard time getting good boys, who are willing to come in and learn the business, while it ought to be exceedingly easy for you."

The dealer had never thought of it that way himself, and when he did give a few minutes' consideration to it, he realized that what his friend had said was true, and likewise that it represented a great opportunity for the development of the best kind of selling talent. He saw that high-school boys, who had had some training along electrical lines, would make excellent material for salesmen, and that they would like the business and take pleasure in its development. And he knew, too, that the youngster who is keenly interested in his work, and who likes it for its own sake, and not merely for the modest stipend to be received at the end of the week, is going to develop into a very useful and efficient member of the organization.

From that day on, the electrical man has been on the look-out for young fellows who are just beginning their business careers. Formerly he paid little or no attention to this phase of the business, taking those who came, when he needed help, and disregarding all applicants when things were quiet. He began, however, making a more careful and systematic selection, and already he has broken in two or three "live wires" who promise to be big men in the business in a few years.

The electrical trade is so attractive that every dealer has a chance to pick and choose, and to get those who will be a credit to themselves and to the business.

A Preachment on Preparedness.

The United States, as a nation, is thinking more about preparedness than ever before. Everybody is willing to concede that it is necessary to make preparations if real results are to be achieved. And this applies as much to business as it does to military affairs.

Take your business, for instance.

If you begin thinking about plans for selling electric fans next summer, instead of waiting until warm weather is right on top of you, your selling campaign would be much more complete, much more effective, and much more profitable.

Of course, you'll sell some fans, no matter whether you make plans or not. If the weather happens to be excep-

tionally hot, you may find your principal difficulty in keeping a stock of fans on hand. But if it should be only moderately warm, if there are plenty of fans to go around, and if the public must be sold, instead of buying without much persuasion, the man who makes money will be the dealer who prepared to sell fans, and the dealer who carries over a stock will be the one who thought fans could be sold without any special effort.

In the first place, as part of the preparedness campaign, you should figure over the results of the past few seasons, weather conditions in mind. Then you should figure on a reasonable increase for 1917. Having decided to do more business, the question will be how to accomplish this. You can get lots of assistance from the manufacturers whose goods you are going to handle, both in the way of selling hints and advertising material.

One little stunt which will start the ball rolling in a profitable direction, and which will require some preparation, is the solicitation of repair business. This should be gone after before the warm weather arrives, and preferably can be handled by means of form letters, so as not to attract too much attention from competitors. Lists for this work, and the "copy" for the letters will require some thought. The same thing applies to a special campaign for rent business, which will have to be worked out.

The dealer who thinks a little about his fan business before the fan season opens up won't have to do so much thinking afterwards.

Fans in First-Aid Work.

Speaking of fans recalls the fact that they are regarded nowadays as important in the equipment of the first-aid rooms of industrial plants.

A leading industrial physician was recently describing the equipment which every first-aid room should contain, and mentioned the electric fan as a necessity.

"What's the idea?" he was asked.

"In summer," he replied, "many employees are overcome by the heat. The fan helps to revive them. Others faint while their injuries are being dressed. The fan helps them, also. It's generally useful, and I would not consider a first aid room properly fitted up if it did not have a fan, preferably of large size, installed."

Reducing the Overhead.

A dealer who was discussing the high cost of doing business the other day made a remark that is worth repeating.

"The only way to reduce expenses," he declared, "is to increase them.

"What I mean is that the best way of holding down the overhead is to hold up sales. If business drops, overhead jumps. Therefore spend more money for sales promotion work, for outside solicitors, for advertising. That is, if conditions justify it, I made a move from one location to another, costing considerably more money in the form of rent, at a time when trade had been dropping off. It was the best thing I ever did. The decision to spend more money brought increased business, and the increase brought down the overhead.

Manufacturers' Helps of Great Aid to Hoover Dealers.

It is reported that as a result of its dealers' prosperity the business of the Hoover Suction Sweeper Company, of New Berlin, O., makers of the Hoover electric suction sweeper, this year is running more than two times ahead of last year's business.

In addition to a large national advertising campaign, which is running at the rate of 7,000,000 advertisements a month in national publications, the Hoover advertising department each month supplies its dealers with a number of attractive, small ads suitable for newspaper use.

Sales suggestions of a timely nature are also furnished each month. To spur salesmen to work hard in selling the Hoovers, prize offers are made at regular intervals. Electrical dealers handling the Hoover speak very highly of the firm's untiring efforts to assist its dealers.

The Appeal of Motion in Window Displays.

Here is an illustration of an exclusive washing-machine store in the high-rent district of Chicago that depends a great deal for its patronage upon passersby who become interested in demonstrations of clothes washing by the electric method. Demonstrations are held at frequent intervals during the day and there are always a few interested spectators who come inside for further particulars. This is another convincing example of the value of motion and the "human element" in a show window. It would be difficult to calculate in dollars and cents the value of this asset to the store pictured.

The more the psychology of window displays is studied, the more clearly is it understood that the display which is in motion is the best display. This is true at least insofar as getting the attention of passersby is concerned, regardless of the after effect; and inasmuch as getting this attention is necessary before the display has any sales value whatever, it is quite evident that to secure it is to have accomplished something worth while.

The electrical dealer is by all odds best fitted for the creation of moving displays, because his stock in trade consists to a considerable extent of devices by means of which motion can be produced. Every dealer ought to connect up his windows so that he can use motors for the operation of appliances of various kinds, or to keep a table filled with merchandise turning slowly, so that it will catch and hold the restless eye of the passing pedestrian.

In connection with the appliance proposition, nothing convinces like a demonstration, and whether it is an electric washing machine or an electrically operated sewing machine, the fact that it is actually running is to the average person the best possible proof that it will do the things which are claimed for it.

NEW APPLIANCES

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

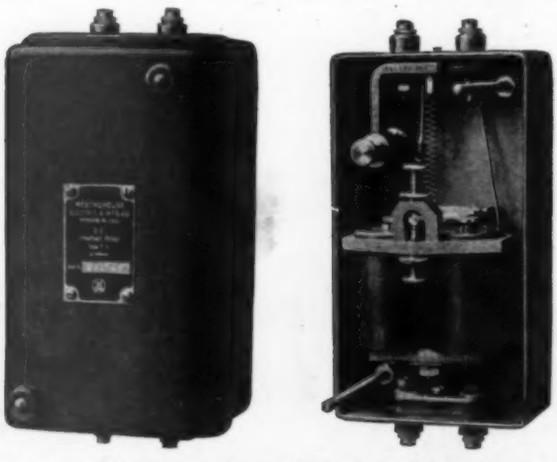
Westinghouse Direct-Current Overload Relay.

The relay illustrated has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to give overload protection on direct-current circuits. It is particularly applicable for use in connection with three-wire generators having but four cables running to the switchboard, as by connecting the control coil of the relay to ammeter shunts, the circuit-breakers can be mounted on the switchboard, yet controlled by the actual armature current as required by the fire underwriters. Without the relay the circuit-breaker must be inserted in the circuit at the position of the ammeter shunt. This would require either that the circuit-breaker be mounted at the generator, away from the switchboard, or that an extra pair of leads be run from the generator to the switchboard.

This relay is known as the type TO. The operating part is a small two-pole electromagnet with special winding. This and an adjusting mechanism are inclosed in a dust-proof case of aluminum alloy. The cover is fastened by two thumb nuts and is easily removed for inspecting or adjusting the relay. The case is finished in black marine to match standard switchboard finish; the internal metal parts are polished and lacquered brass.

In operation, the pull of the relay coils is opposed by a helical spring. When the pull exceeds the tension of the spring the contacts close. A calibrated adjustable arm is used to adjust the tension of the spring to regulate the voltage drop across the ammeter shunt at which the contacts will close. The relay contacts will close a circuit of one ampere. When the circuit-breaker trip coil requires more than this, an auxiliary relay switch should be used.

These relays can be used with a standard 50-millivolt



Outside and Inside Views of New Westinghouse Direct-Current Overload Relay.

ammeter shunt (the same shunt that is used with the ammeter) without affecting the readings of the ammeter appreciably. They are calibrated for adjustment to close contacts at from 40 to 80 millivolts, corresponding to 80 to 160 per cent of full load, according to an adjustable scale provided within the instrument allowing adjustment for all intermediate values.

Where a relay is used, the circuit-breaker should have auxiliary contacts to open the trip circuit when the breaker opens, relieving the relay contacts of this duty. Further, this type of relay is instantaneous in operation. If a definite time element is desired, a definite-time-limit relay should be used in connection with it.

Electrically Operated and Lighted Alarm Clock.

A great convenience in a bedroom is to have a reliable alarm clock to arouse the sleeper in ample time for the day's duties. Such a clock, electrically operated and with a special electric-light attachment, has now been made by the F. W. Jansen Clock Company of New York, 149 Church Street, New York City. As shown in the illustration, this is a very handsome clock which adds to the appearance of any dresser or other

Automatic Electric Alarm Clock with Nitelite Attachment for Illuminating Dial.

bedroom furniture. The clock itself is of high grade and is electrically wound. In the bottom of the clock case is a dry cell which furnishes current for operating the clock, for ringing the alarm and for lighting the lamp shown just below the dial. This lamp is controlled by a push-buttom connected to a cord of considerable length, the button being placed near the bed so that by pressing it the dial is illuminated and the time observed at any period of the night without getting out of bed or other discomfort. This outfit is called the Nitelite alarm clock. It is entirely automatic except for manipulation of the switch that must be set to permit the alarm to ring and by which it is shut off.

Exhaust Ventilating Fans with Special Wall Thimbles.

Good ventilation involves two elements, supply of fresh tempered air and removal of foul or otherwise objectionable air. In a large installation, such as an auditorium or school room, attention must be given to both these elements. In the smaller installations the local conditions will determine which element is to be given primary consideration. For the kitchens of up-to-date residences and apartment buildings, for toilets, smoking rooms and other small inclosures where heated, damp, smoky or malodorous air is apt to collect, it is desirable to make provision at least for the posi-

tive removal of the objectionable air. This requirement can be best met by an electric exhaust fan installed with an appropriate wall thimble to direct the exhausted air through an outside wall.

The fan or inner end of such an outfit is shown in Fig. 1, which is a 12-inch Parker-blade exhauster with alternating-current motor mounted on a wall thimble. A detailed view of the two parts of this thimble is shown in Fig. 2. It consists of an outer rectangular frame or louver with three adjustable iron shutters to permit closing the opening entirely or to open it to any desired extent. Fitting into the circular extension of the outer frame is a circular sleeve that is adjustable in its amount of penetration to allow for

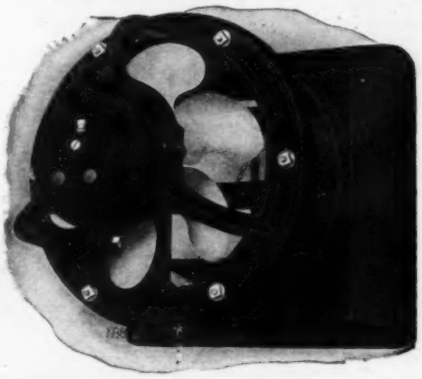


Fig. 1.—12-Inch Exhaust Fan with Parker Blades, Shown Mounted on Inside of Wall Thimble.

different thicknesses of walls, varying from 9 to 13 inches. A rib on the circumference of this round sleeve prevents its turning in the outer sleeve. To the flange of the inner sleeve is secured the mounting ring of the exhaust fan, six bolts being used for the connection. The three shutters or vanes in the louver are adjusted by means of a chain to the desired angle. This is done against the force of a spring that normally holds the vanes tightly shut, so that strong wind pressure will not cause the vanes to open nor to rattle when the fan is not in use.

While these wall thimbles are a part of a complete exhaust-fan equipment, it is desirable to have them built into the wall while the building is being constructed even though the fan itself is not provided immediately. In this way changes in the wall are avoided subsequently. For this purpose the thimbles can be secured independently of the fans. However, it is not very difficult to install both fan and wall thimble at any time.

These exhaust fans and wall thimbles therefor are manufactured by the Emerson Electric Manufacturing Company, 2030 Washington Avenue, St. Louis, Mo.

Electric Heaters Used in Making Money.

In the Bureau of Engraving and Printing, Washington, D. C., there are 600 electrically heated industrial stoves in use for the heating of engraved plates from which bank notes are printed. In the accompanying illustrations some of these units (made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.) can be seen. These stoves are spring-mounted in a cradle so that there is a pressure upward against the under side of the plate. The construction is diagramatically shown in the sketch. Cutler-Hammer type H heater units are integrally united to the top plate of the stove by electric welding and the top plate and heating units therefore become virtually one piece.

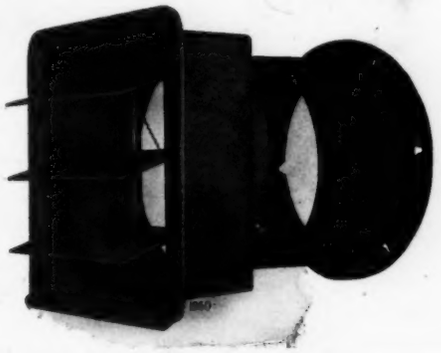


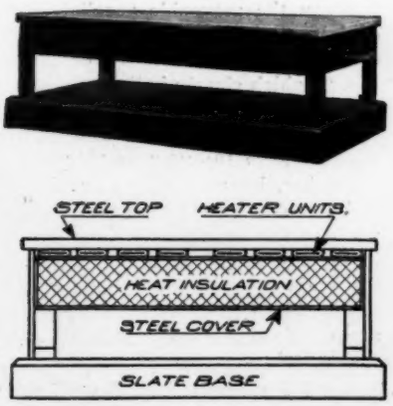
Fig. 2.—The Two Parts of the Wall Thimble for Use with Electric Exhaust Fans.

There is perfect and permanent contact and the heat is generated right where it is needed. The upper plate is steel.

Electric stoves of this construction can be made in sizes and shapes to suit various applications, such as for velouring in hat factories; for sweating-on machines used in mounting electrotype metal blocks to the copper shell; for embossing work; for laboratories; and for many industrial purposes. The electric stove can be used for all purposes for which the gas or coal stove can be used and for many purposes for which the latter cannot be used. As there is no fuel to be burned, there is absolute cleanliness, a reduced fire risk and no vitiation of the air. The heat is uniform, can be easily controlled, and is not affected by drafts of air.

The 600 stoves in the Bureau of Engraving referred to above, if heated by gas or other agent, would vitiate the air and the clean walls and ceiling as noted in the picture would not remain so for long. As a central-station load the electric industrial stove is very favorable, because of its many possible applications.

View in Bureau of Engraving and Printing, Showing a Few of the C-H Electric Stoves for Heating Engraving Plates for Currency.



Perspective and Detail Views of One of the C-H Electric Stoves.

New Parallel-Line Computer to Replace Slide-Rule for Rapid Calculations.

The geometrical principles of parallel lines have been known for several thousand years, but it is only quite recently that they have been made use of in convenient form for rapid computations. A number of computing instruments based on the behavior of a pair of movable parallel lines has been invented by Yu Wang, a Chinese, who has made a life study of applied mathematics. These instruments, including the Z Computer, the Computing Board and the Wang Precision Computer, employ mathematical scales that are nonlogarithmic. The instruments, therefore, do away entirely with the use of slides, runners or movement of scales, and, therefore, are said to be superior to the ordinary slide-rule so much in use.

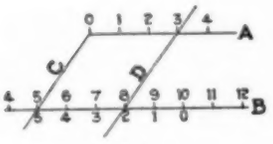


Fig. 1.

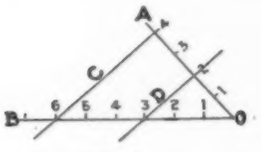


Fig. 2.

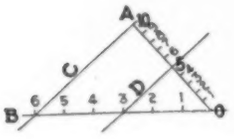


Fig. 3.

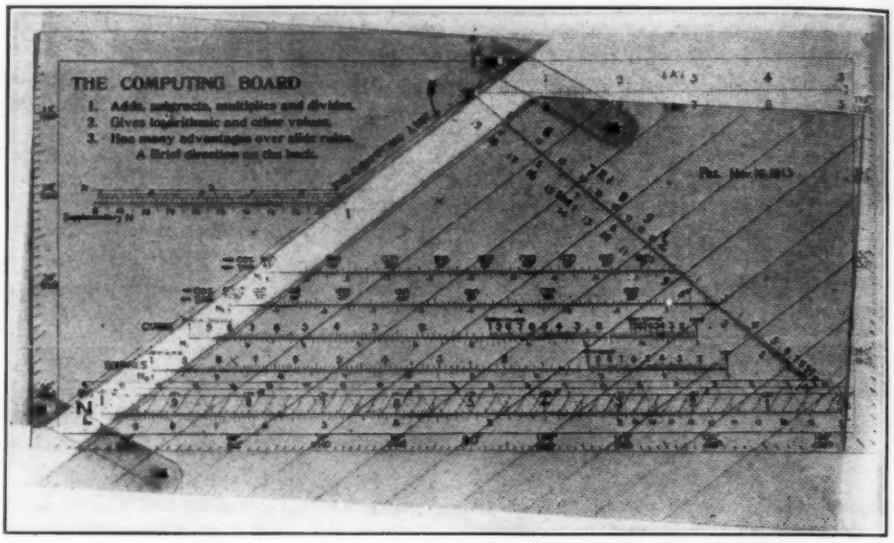

THE COMPUTING BOARD
1. Adds, subtracts, multiplies and divides.
2. Gives logarithmic and other values.
3. Has many advantages over slide rules.
A brief direction on the back.

Fig. 4.—The Wang Computing Board.

In the accompanying illustrations are shown diagrams of the elementary principles of and a completed form of the Wang Computing Board. One of the parallel lines swings over the scales, while the other one moves parallel to the first, being separated from it by means of a parallel ruler. When these parallel lines are moved over parallel scales, as shown in Fig. 1, addition and subtraction can take place. For instance, if line *C* is swung to point 5 on scale *B*, the line *D* indicates 8 if it is moved to point 3 on scale A, being kept parallel to *C* in the meantime. This gives $5 + 3 = 8$. When the scale *B* is reversely numbered, as it is underneath the line, the process becomes subtraction, and one reads the figure 2 instead of 8, thus $5 - 3 = 2$.

When the moveable parallel lines are swung on a pair of intersecting scales that are numbered from the same origin, they indicate ratios or proportions, as is shown in Fig. 2, which clearly indicates a ratio of 4:6::2:3. However, if the line *C* is hinged at point 10 (Fig. 3) the proportion can be used either for multiplication or division, because we now have 10:6::5:3 or $5 \times 6 = 30$, or $30 \div 6 = 5$.

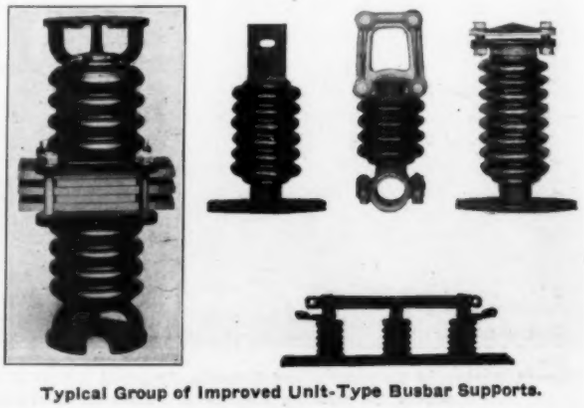
Further, by multiplying or dividing the numbered cale *B* by a common number the same principle holds true, while at the same time the number of figures in the reading is thereby increased or decreased. For example, suppose the scale *B* to be multiplied by 5 so that point 6 will be replaced by 30, then point 3 will become 15, and more figures are obtained in the readings. By this multiplication of scales it is possible to make a precision computer which can compute more figures than the ordinary slide-rule; in fact, three or four figures can be directly read off from the scales and the fourth and fifth figures can be estimated.

Aside from the merits above enumerated, this instrument has the further advantages that it is low in cost, and possesses the possibility of being able to add scales that will greatly facilitate the calculation of complex problems, all the time eliminating settings and intermediate readings which cannot in many cases be done by the slide-rule. The computing board shown in Fig. 4 is made especially for such general use. It has logarithmic and trigonometric scales, squares and cubes and corresponding roots, besides the simple scales for addition, subtraction, multiplication and division.

These instruments are being marketed by the Scientific Devices Company, 45 John Street, New York City, of which Mr. Wang is president.

Improved Busbar Supports.

Several years ago a line of universal interchangeable-unit form of busbar supports for use in outdoor substations was developed by the Delta-Star Electric Company, Chicago, Ill. The interchangeability of these supports has proved a very strong point in their favor. To meet new conditions the manufacturer has further developed this line of devices, and a great many new combinations are now available using these supports. A few of the new unit type of such supports are shown in the accompanying illustrations. The flexibility of construction of these supports enables assembling the parts in several thousand combinations for mounting, not only busbars, but also disconnecting switches, choke coils, air-break switches, etc.



Typical Group of Improved Unit-Type Busbar Supports.

Delco Light Plants for Rural Service

WITHIN the last year a new electrical concern has made its appearance under circumstances and with a record which are attracting the attention of the whole electrical industry.

About five years ago the engineers who are responsible for the success of Delco starting, lighting and ignition equipment for automobiles undertook the development of an isolated electric light and power plant suitable for use on farms, in country homes, churches, schools, stores, camps and other places beyond the reach of central-station service.

Last spring after four years of experimental work at a cost of over a quarter of a million dollars, the plant was pronounced ready for the market. A new concern, the Domestic Engineering Company, was organized at Dayton, O., to manufacture and sell the new product. About a year ago this new company employed six men in its office, seven in its factory, and seven salesmen. On the first of February, 1917, there were over 150 in the office, about 500 in the factory and 1,500 salesmen covering practically all the world.

Over 10,000 plants were sold and shipped during the first eight or nine months and plans are in operation for a much larger business during this year.

A new factory, the largest building of its kind in the world, is being built at a total construction and equipment cost of over one and one-half million dollars.

With these facts in mind, it is instructing to consider some of the facts in regard to the design and working of this new electrical product.

The "Delco-Light" plant consists of two units, a generating unit and a storage unit. The generating unit is composed of a gasoline engine, electric dynamo and switchboard, all assembled into one compact mechanical unit.

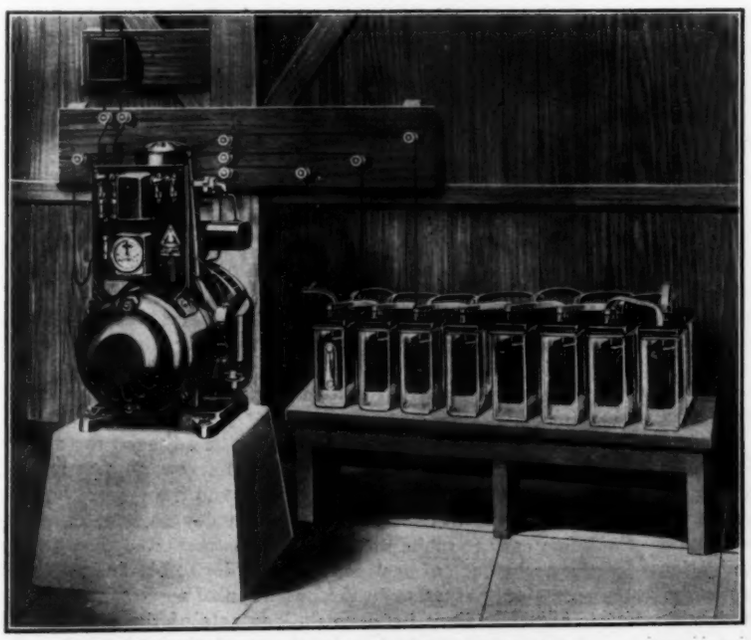
The gasoline engine is of the standard four-cycle type with valves in the head. Its design is extremely simple. The crank shaft is supported by two bearings, one a New Departure ball bearing and a Hyatt roller bearing. The ordinary carburetor is replaced by a simple mixing device, very much like those used on gas grates. Lubrication is supplied by a gear which revolves on a spindle in the crank case, throwing a fine mist of oil over all moving parts. This gear is driven directly off the crank shaft. Ignition is supplied by a simple high-tension induction coil, the primary circuit of which is connected with the storage battery and the secondary with the spark plug. The cooling is done by air. A draft tube, open at the top, fits over the cylinder, which is cast with large radiation fins. This tube is bolted at the bottom to the outer edge of the double crank case. The flywheel, which is cast in the form of a centrifugal turbine fan, is set close to the rear edge of this double case. In revolving, it draws air through the draft tube, over the cylinder and around the crank case, and then forces it out through the flywheel fins. This system provides perfect cooling at all times.

The electric dynamo, which operates as a motor merely for starting and then as a generator, is connected directly to the gasoline engine, that is, its armature is keyed onto one end of the crank shaft. In operation it delivers about 750 watts.

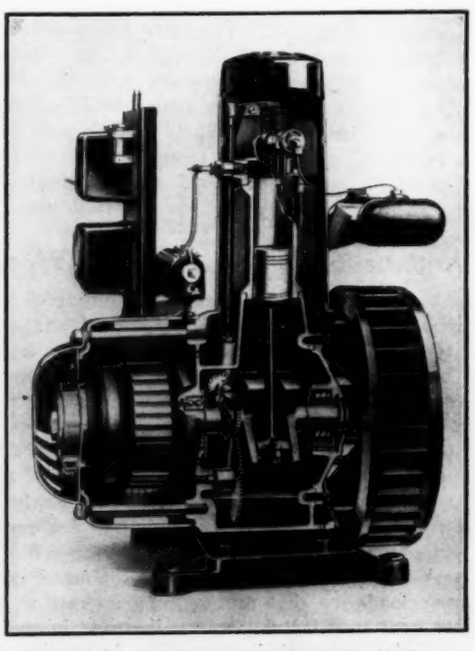
On the switchboard, which is located on top of the generator housing, are placed the necessary switches for operating the plant, fuses for protecting the power and generating circuits, and a combined ampere-hour meter and ammeter, which shows the exact condition of the battery and the rate of charging or discharging at all times.

The storage battery is of the lead type and is composed of 16 cells in glass jars; each cell normally gives two volts. The battery is made in two sizes, one of which has a capacity of 80 ampere-hours, and the other 160 ampere-hours. One of the cells is a pilot cell; in it is a white ball, which floats or sinks according to the condition of the battery. By this means the condition of charge of the battery, which must usually be determined by testing the electrolyte in each cell with a hydrometer syringe, can be determined at a glance.

The operation of the plant is very simple. It is started by closing the starting switch on the switchboard. This causes the electric dynamo to receive current from the battery and, running as a motor, to crank the gasoline engine. As soon as the latter begins to fire, the motor auto-



General View of Delco-Light Plant Installed with Battery.



Internal View of Engine and Generator Unit.

matically becomes a generator and the battery begins to be charged. Electric current is then taken from the battery for the operation of lights and various power appliances.

In ordinary service the plant is operated two or three times a week. This is often enough to keep the battery well charged at all times. The plant is self-supporting, that is, when the battery is fully charged, the generating unit stops automatically. This feature not only prevents overcharging of the battery, but makes it unnecessary for the operator to return and shut off the plant when the battery is fully charged.

The plant is usually installed in the barn or some other outbuilding on the farm, though it may be installed in the basement of the farm house, if desired.

From the plant two main lead wires carry the current to a junction box where the various lighting and power circuits branch off. On these circuits are operated the necessary lights and power appliances. It is found that the average farm installation requires from 25 to 50 lamps. The lamps, of course, vary in wattage, but the average farm uses 20, 40 and 60-watt lamps as a rule. In addition to the current consumed by the lamps, ample power is furnished for the operation of a large variety of light power appliances, such as washing machines, cream separators, churns, vacuum sweepers, fans and even complete pumping systems which furnish running water to all parts of the house and barns.

The plant operates on gasoline, kerosene or natural gas, about one gallon of fuel being consumed during a charging run, the normal length of which is four or five hours. It is estimated that the cost of operating the plant is about five cents per day.

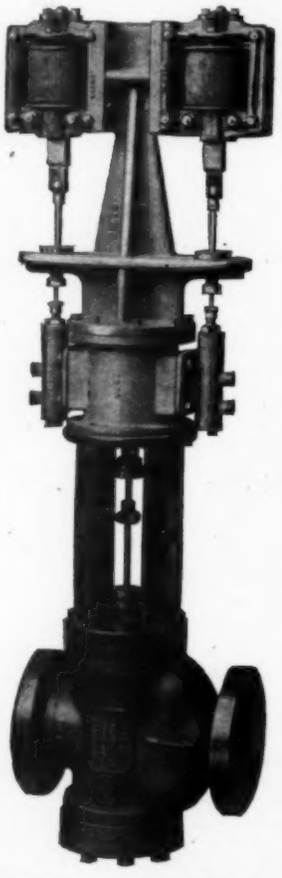
There are two features of the Delco-Light plant that are of great practical importance. In the first place, its mechanical simplicity, which has been carried to the point of the elimination of all but the absolutely necessary parts, insures not only freedom from trouble and repairs, but a remarkably low cost of operation. Secondly, in the design of the plant the greatest care has been taken to preserve the best possible relation between all parts. This helps to increase the operating efficiency of the plant.

The Delco-Light plant is more than a commercial product. It is not merely a plant for furnishing electricity on the farm and suburban home. It is the solution of a very complex and difficult problem—the rural light and power problem. And it is a complete solution because the most painstaking study and experiment has been put on every phase of this problem, resulting in the production of a plant that is low in first cost, low in operating cost and free from trouble and repair expenses—a plant that with a minimum of attention from its owner will furnish safe, dependable and economical electric light and power in quantities ample for any rural installation.

Automatic Regulator for Pulp-Wood Grinders.

As a means for obtaining maximum production with highest efficiency from available pulp-wood grinder equipment of paper mills, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed and is marketing the automatic pressure regulator shown. This regulator occupies a unique position due to the fact that in its operation it is an active agency in automatically maintaining the service rendered by the power plant at a higher degree of uniformity and satisfaction than can be accomplished through almost any other medium. Among the numerous advantages claimed for this regulator are: prevention of peak-load charges and overload on motors; elimination of underloads, so that motors may operate at practically 100 per cent load-factor, and an increase in the production of ground wood with improvement in quality and uniformity of the pulp. It causes a reduction in the amount of splinters or shives and in the amount of short fiber carried away in the white water, is absolutely foolproof, and can be adjusted to control the grinder load only, or the entire mill load.

In installing the regulator, a series or current transformer of suitable ratio is placed in circuit with the motor driving the grinders and so connected that fluctuations of load will cause the moving element of a primary relay to respond. This moving element operates either up or down, depending upon whether the load is above or below a predetermined value. As the primary regulating relay element moves upward or downward beyond a certain adjustable distance, a set of contacts is closd, causing a secondary relay or magnet switch to operate, which energizes one of the solenoids of hydraulic regulator valve. The core of the solenoid is then instantly raised to its extreme position, opening both ports, which were previously closed, thus admitting hydraulic pressure to the upper end of the cylinder through the other pilot-valve port. The piston in the cylinder is thereby forced downward, opening to a large extent the balanced regulating valve. This allows an increase in pressure in the grinder cylinders, increasing the load on the motor driving the grinders.



Regulator for Pulp Grinder.

When the electric load has reached the point for which the primary relay is set, the primary circuit is broken, causing the secondary relay to break the secondary circuit. The core of the solenoid then drops immediately, forcing the pilot-valve piston to the lower position, and closing both ports, which prevents the admission or escape of water from the hydraulic cylinder. Consequently, the piston of the hydraulic cylinder is locked in the exact position when the pilot valve closes. As long as the load remains constant, a state of equilibrium will exist in the system, but if the load should increase above the point for which the primary relay is set, contact would be made in that direction, causing the other switch of the secondary relay to close its secondary circuit, energizing the other solenoid and opening the other pilot valve The opening of this valve causes both its ports to open, admitting hydraulic pressure to the lower end of the hydraulic cylinder through one of its ports and exhausting water from the upper end of the cylinder through its other port. Thus some of the pressure applied to the grinder pockets and likewise the load on the grinder motor are both reduced.

The primary regulating relay can be adjusted for any degree of load by raising or lowering a screw, so that in cases where central-station power is used and the power company changes the available demand from day to day, it will be found easy to make the desired adjustment and thus prevent the occurrence of peak loads. In order to obtain stability of operation, necessary in the operation of any governor, there is a certain limit between the contacts of the primary regulating relay at which point the regulating valve is inactive.

LATEST APPROVED FITTINGS

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, after examination and tests conducted under standard of the National Electric Code as recommended by the National Fire Protection Association

LAMPS—ARC. — Brenkert Light Projection Company, Detroit, Mich.

Theater lamps consisting of arc lamp and house, rheostat and control switch, all mounted on adjustable stand.

Spot lamp type alternating current and direct current, 25 amperes, 110-220 volts, catalog Nos. BC25, BC30, BC35, BC40.

Theater lamps consisting of arc lamps and house and control switch.

Spot lamp type alternating current, 50 amperes, 110-220 volts, catalog No. SD45.

Listed February 2, 1917.

LAMPS—ARC. — Sprague Electric Works of General Electric Company, New York, N. Y.

Theater lamps consisting of arc lamp and house, rheostat and control switch, all mounted on adjustable stand.

Flood-lamp type alternating current, 25 amperes, catalog No. 78705, direct current, 25 amperes, 125 volts, catalog No. 78688.

Spot-lamp type alternating current, 25 amperes, 125 volts, catalog No. 78687, direct current, 25 amperes, 125 volts, catalog No. 78686.

Listed February 2, 1917.

LAMPS—ARC.—Universal Electric Stage Lighting Company, 240 West Fiftieth Street, New York, N. Y.

Theater lamps consisting of arc lamp and house, rheostat and control switch, all mounted on adjustable stand. Spot-lamp type, direct current, 30 amperes, 125 volts, "Kleigl."

Listed February 2, 1917.

MEDIUM BASE RECEPTACLES. —John I. Paulding, New Bedford, Mass.

"Paulding." Porcelain Shell. Keyless, catalog Nos. 1-3, inclusive, 9403, 50715.

Listed February 1, 1917.

MEDIUM BASE SOCKETS.—General Electric Company, Schenectady.

"G. E." Porcelain Shell. Key, catalog Nos. GE099, GE567-69, inclusive, GE596-97. Keyless, catalog Nos. GE100, GE598-99. Pull, catalog Nos. GE639-44, inclusive. Waterproof composition sockets. Keyless, catalog Nos. 43310-14, inclusive, 60666. Metal shell. Keyless, catalog Nos. 25709-10, 32440-43, inclusive, 50701-02, 59323-24. Porcelain shell. Keyless, catalog Nos. 9366, 9448, 9496, 37695, GE040, GE111, GE469, GE525, GE530.

Listed February 5, 1917.

MOTION PICTURE MACHINE.—Victor Animatograph Company, Davenport, Ia.

Hand operated type. 400 watts, 110 volts, 660 watts, 32 volts, Animatograph Model 2.

Listed December 19, 1916.

MUSICAL INSTRUMENTS — PIANOS.—Link Piano Company, Inc., Binghamton, N. Y.

Automatic piano operated pneumatically by a motor-driven bellows contained within instrument case. A special coin switch is operated either by a mechanical escapement or by a magnet supplied by an auxiliary dry battery to operate switch controlling 110-volt motor and light circuit. "Link." 0.125 horsepower, 110 volts, alternating current or direct current.

Listed January 26, 1917.

OUTLET BUSHINGS.—B. & D. Electric Company, 81 High Street, Boston, Mass.

Porcelain fittings having separate openings for each wire and secured at ends of rigid steel conduit by threaded steel plates, catalog Nos. 103, 303.

Listed December 14, 1916.

OUTLET PLATES.—B. & D. Electric Company, 81 High Street, Boston, Mass.

Cast-iron outlet plate for straight electric fixtures, catalog No. 13.

Listed December 14, 1916.

RECEPTACLE (For Attachment Plug) AND PLUG.—Benjamin Electric & Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

"Benjamin," 660 watts, 250 volts, catalog No. 7640.

Listed December 27, 1916.

ROSETTES, Fuseless.—Adapti Manufacturing Company, 919 West Street, Cleveland, O.

"Adapti," 3 amperer, 250 volts, catalog No. 713.

Listed December 30, 1916.

RECEPTACLES, Medium Base.—Wheeler Reflector Company, 156 Pearl Street, Boston, Mass.

"W. R. Co.," porcelain shell, Keyless catalog No. 1,275.

Listed Decembed 27, 1916.

RECEPTACLES (For Attachment Plugs) AND PLUGS.—Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"C-H," 10 amperer, 250 volts, catalog No. 7,755.

Listed January 12, 1917.

CORD CONNECTOR.—Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Cord connector for use with fuseless attachment plugs.

Listed January 12, 1917.

OUTLET BUSHINGS.—Winner Manufacturing Company, 810 E. Street N. W., Washington, D. C.

PICTURE MACHINE APPLIANCE.—Feaster Film Feed Company, 120 West Forty-second Street, New York, N. Y.

"Feaster No-Rewind Machine." Film feed machine, special horizontal upper magazine and reel so designed that by unwinding film from center of reel it can be repeatedly exhibited without rewinding it.

Two types, for attachment respectively, to Power's Cameragraph No. 6 A., made by Nicholas Power Company, New York, N. Y., and to Simplex Projector, made by The Precision Machine Company, New York, N. Y.

Listed January 30, 1917.

RECEPTACLES FOR ATTACHMENT PLUGS.—Brant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins" Spartan, 660 watts, 250 volts, Adapter Spartan to Edison, catalog Nos. KF, MF., 10 amperes, 250 volts, catalog Nos. 111, 113, 120, 122, Caps KA-KD inclusive, KG, MA-MD, inclusive, MG. Heater Control Combination. Each of these devices consists of assembly of two or more of following parts mounted on single porcelain base for attachment plug, indicator-lamp or receptable and switch, 5 amperes, 250 volts, catalog No. 117; 10 amperes, 125 volts, catalog No. 558. Switches for use with above devices are standard and labeled.

Listed January 29, 1917.

SIGNS—Strauss & Company, 209 West Forty-eighth Street, New York, N. Y.

Electrically illuminated display signs for general use.

Listed February 10, 1917.

SIGN FLASHERS.—Phelps Manufacturing Company, 265 Jefferson Avenue, Detroit, Mich.

Thermostatic flashers, each consisting of carbon contractors, carried on steel springs and mounted in cast-iron box having pipe extension containing thermal element. Type "J" 2-25 amperes, 125 volts, catalog Nos. 111-120, inclusive, 150-55, inclusive. Combined thermostat sign flasher and receptacle "Baby" 60-100 watts, 110 volts. Combined thermostat sign flasher and socket plug. "Skedoodle" 40-60 watts, 125 volts.

Listed February 2, 1917.

SOCKET LININGS.—The Pairpoint Corporation, New Bedford, Mass.

Linings made by this manufacturer have been examined and tested and found, in general, suitable for use in sockets and receptacles under specifications of Rule 72d of National Electrical Code. "Diamond P."

Specifications for the more complete and exact examination and test of socket lining are in course of preparation and will be used as the basis of a further report on these linings and others of their class.

Listed February 13, 1917.

SWITCHES. Combination Cutout.—Detroit Fuse & Manufacturing Company, Detroit, Mich.

Porcelain base switches, catalog Nos. 1402-03.

Listed January 31, 1917.

ACTIVITIES IN THE TRADE

The Globe Stove & Range Company, Kokomo, Ind., has just issued its price list for February. This list includes prices on electric ranges and other heating devices as manufactured by the Globe company.

The Philectric Company, 796 Prospect Avenue, S. E., Cleveland, O., is the new company which was formerly known as The Joseph Phillips Company, 2114 East Second Street, Cleveland, O. This company as before will manufacture a complete line of flashlights and other electrical appliances.

The De Laval Steam Turbine Company, Trenton, N. J., manufacturers of steam turbines and helical reduction gears, centrifugal pumps and air compressors and similar apparatus, announces the opening of a district sales office in the Smith Building, Seattle, Wash., in charge of Mr. William Pullen.

General Electric Company, East Orange, N. J., has filed plans for the erection of a three-story addition to its local Edison Lamp Works at Springdale Avenue and North Eighteenth Street. The structure will be about 94 by 138 feet, with a wing 28 by 40 feet, and is estimated to cost $80,000.

The Locke Insulator Manufacturing Company, Victor, N. Y., in an interesting booklet entitled "The Insular Book" and just issued by the company, presents 10 designs of insulators, as manufactured by this company. Catalog descriptions, illustrations and dimensioned drawings are shown for each one of the 10 designs considered in this booklet. The voltages which these insulators are designed for range from 27,000 to 80,000 volts, and they include designs with two, three and four petticoats.

Harvey Hubbell, Incorporated, Bridgeport, Conn., in its bulletin No. 15-22, describes a line of steel reflectors for the lighting systems in industrial plants. The shades are finished in green on the outside and in white enamel on the inside. There are two different types described in the bulletin as the extensive type and the distributing type. The former's reflectors are deep, and the sides of the reflector are at a steep angle, while the distributing type is more flat, and reflects the light so as to cover a larger rather than such a concentrated area.

Ivanhoe-Regent Works of the General Electric Company, Cleveland, O., has given much valuable information regarding light shades in the February issue of *The Hunchman,* which is published by the company as an aid to help dealers handling Regent and Ivanhoe products, which are manufactured by this company. Many illustrations and descriptions are given of various styles of shades from imposing units for use in store lighting to the smaller sizes of shades used in homes. Besides describing these shades many advertising schemes are described and illustrations reproduced of the advertisement itself.

Norberg Manufacturing Company, Milwaukee, Wis., has recently shipped through Mitsui & Company a large electric hoist for installation at the Ashio Copper Mines of Furukawa & Company, Tokyo, Japan. The mines at which the new hoist is to be installed are the largest copper producing group owned by the company. The design of the hoist is in general similar to many other electric hoists built by the Nordberg company for installation in the country. The drums are 10 feet in diameter and good for an 1,800-foot depth. The drive is by motor, through herring-bone gears, the energy being supplied from a nearby hydroelectric plant.

The Franklin Electric Manufacturing Company, Hartford, Conn., has just published the March issue of *"Poor Richards New Almanac."* The text is written in Old English style and being out of the ordinary will be found very interesting. It contains various attractive notes about Mazda lamps as manufactured by this company, and one of these notes is given in almanac form for each day of the month of March. Other short stories in Old English are also given which bring out the use of Franklin Mazda Lamps.

The Esterline Company, Indianapolis, Ind., engineers and manufacturers of graphic meters, permanent magnets, electrical specialties, etc., has recently appointed James G. Biddle, 90 West Street, New York, N. Y., as district sales agent for the company's graphic efficiency instruments in New York and the New England states. This New York office is in charge of H. H. Sticht, resident sales engineer. For a number of years the home office of James G. Biddle was at 1211 Arch Street, Philadelphia, Pa.

Schweitzer & Conrad, Berteau and Ravenswood Avenues, Chicago, Ill., manufacturers of fuses, pole-top cut outs, high-voltage detectors, reverse-phase relays, flow meters and other electrical equipment, has recently moved its factory from the Berteau Avenue location to 4431-39 Ravenswood Avenue. The new factory is a modern, one-story, saw-tooth factory which is 100 by 150 feet. The saw-tooth roof construction permits of very good light in the factory.

Sangamo Electric Company, Springfield, Ill., has just gotten up two bulletins Nos. 45 and 46. They are gotten up in an interesting and comprehensive manner. The first mentioned bulletin deals with ampere-hour meters and the second with kilowatt-hour meters as manufactured by this company. In each of the bulletins a discussion is first given as regards what a meter should be, and how it should be constructed. Very detailed descriptions are then given of the construction of the various meters, and this includes information on how the meter should be operated, and how to test and adjust it. In all cases illustrations, sectional views and line drawings accompany the description, so as to make it exceptionally clear to the reader. Curves are also reproduced, which show the results of various tests made on meters of the classes described in these bulletins. Besides the information given, relative to the particular meters as manufactured by this company, considerable information is also given which will be found of interest from a general point of view with respect to ampere-hour and kilowatt-hour meters.

Row & Davis, Engineers, Incorporated, 90 West Street, New York, N. Y., has just published two interesting bulletins, Nos. 51 and 52, on evaporators for the making of pure distilled water for various purposes and on feed-water heaters. The Paracoil Evaporators, as described in bulletin No. 51, illustrates and describes the construction and operation of the evaporator in a very complete manner. The water to be evaporated and distilled is passed through coils inside of the heater, which in turn are heated by steam at any pressure. Among some of the interesting features given for this evaporator in the bulletin, is the new, patented manifold, which is mounted on a hinged door, so as to readily permit of cleaning, inspection, etc. The Paracoil Feed-Water Heater described and illustrated in bulletin No. 52 operates in a somewhat similar manner to the evaporator, and the description and illustrations bring out the construction of this equipment in an interesting manner.

PERSONAL AND BIOGRAPHICAL

AVERY SCHILLER has been made assistant manager of the Adirondack Electric Company, Glens Falls, N. Y.

MR. BENJAMIN F. CRESSON, Easton, Pa., president of the Easton Gas Company, has resigned, after serving in such capacity for 14 years.

MR. W. PORTER JONES, formerly new-business manager of the Oklahoma Gas & Electric Company, Oklahoma City, has been appointed manager at Norman, Okla.

MR. DONALD STEWART, lately of Baton Rouge, La., has been appointed general superintendent of the Connecticut Power Company, New London, Conn.

MR. J. B. JOHNSON, general manager of the Lorain County Electric Company, is expecting to make his headquarters in Lorain, O., in the very near future.

MR. A. H. ARMSTRONG, engineer for heavy traction, General Electric Company, Schenectady, N. Y., spoke before the Lynn Section, A. I. E. E., at a meeting February 28, in the Washington School, Lynn, Mass.

MR. C. E. DAVIS, New England district manager, General Electric Company, Boston, has recently returned from an extended tour of the orient. He left last September, and in course of his journey visited Japan and the Philippine Islands.

MR. GEORGE T. FISHER, commercial manager of the Cumberland County Power & Light Company, Portland, Me., for several years, will sever his connection with that company and about April 1 will assume new duties in Philadelphia. Pa.

DR. PETER COOPER HEWITT, research engineer, inventor and president of the Cooper Hewitt Electric Company, has moved his offices from the Madison Square Garden Tower, Twenty-sixth Street, New York, N. Y., to 18 East Thirty-third Street, New York, N. Y.

MR. B. F. HIRES, Bridgeton, N. J., manager of the Bridgeton Electric Company, and Bridgeton & Millville Traction Company for the past 17 years, has been appointed special agent of the American Railways Company, which operates the above companies. Mr. Hires has also been manager of the Electric Company of New Jersey for the past year. He will be succeeded by Mr. W. J. Kyle.

MR. GEORGE B. TRIPP has resigned as vice-president of the United Gas & Electric Engineering Corporation and will devote his time in the future to the management of the Central Construction Corporation of Harrisburg, Pa. He will, however, continue in his present capacity as vice-president of the Harrisburg Light & Power Company, Harrisburg, Pa.

MR. FRED C. BUTLER, for a number of years manager of the Greenfield (Mass.) Gas & Electric Company, has been appointed general manager of the holding company which controls that corporation, the Keene (N. H.) Gas & Electric Company and the Laconia (N. H.) Gas & Electric Company, succeeding the late COLONEL G. M. ROSSMAN, of Keene. Mr. Butler will continue to reside at Greenfield, Mass.

MR. C. S. COOK, manager of the Railway and Lighting Department of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, Pa., was on March 1 selected as general manager of the Duquesne Light Company to fill the vacancy created by the death of Mr. Robert S. Orr. Mr. Cook was born in Massachusetts, educated at the Worcester Polytechnic School, from which he graduated in 1887. He was first employed in the old Westinghouse Electric Company's

C. S. Cook.

plant in 1887. At that time the electric company shared a very small building in Garrison Alley with the Union Switch & Signal Company. Mr. Cook served in the shops and testing room and in 1888 was made construction engineer in building lighting and power plants. In 1889 he became engineering superintendent of construction in the Chicago office and in 1895 he returned to Pittsburgh to take charge of special sales engineering work in the Pittsburgh district. In 1899 he became manager of the Pittsburgh office of the Westinghouse Electric & Manufacturing Company, which position he retained until 1904, when he assumed the position at East Pittsburgh from which he has just retired. In this department he had control of all commercial operations relating to power machinery for public service corporations.

MR. F. A. WILLIAMS has been appointed to the position of clerk of the Board of Electrical Examiners of Massachusetts, succeeding MR. HERBERT DALLAS, who resigned to take up work with the State Board of Education. Mr. Williams is a native of Boston and held responsible positions with the Hixon Electric Company and the M. B. Foster Company for 11 years. During four years past he was instructor in electricity in the Boston Trade School.

MR. CHARLES HERRICK has accepted the position and is now master mechanic of the Reading Transit & Light Company, Lebanon, Pa.

MR. W. H. GRIMES recently accepted the position of superintending the operations of the Central Illinois Public Service Company in the city of Anna, Ill.

MR. L. K. FUNKHOUSER, director, and secretary and treasurer of the Dayton Power & Light Company, has resigned his position with that company and in the future will give his attention to personal interests in Dayton, O., and also in the western United States. He started with the company eight years ago as a time-keeper and later had considerable to do with the working out of the accounting system adopted by the public utilities commission of Ohio and used by many of the electric-light companies of the state.

MR. B. J. GRIGSBY has associated himself with the Anderson Electric Specialty Company, 562-564 West Van Buren Street, Chicago, Ill., and will assume his duties as vice-president and general manager of the company during the present month. Mr. Grigsby was formerly managing director of the Benjamin Electric, Limited, London, England. He assumed this responsibility in 1908 and continued in that capacity until December, 1916, at which time he resigned and returned to this country to take up his present position.

OBITUARY.

COLONEL CURTIS VICKERY HARD, president of the Cleveland Light & Power Company, died suddenly on February 20, at his home in Wooster, O., at the age of 72 years. Colonel Hard, who was a Civil war veteran, was made colonel of the Eighth Ohio infantry at the opening of the Spanish-American war and saw service at Santiago. He was president of the Wooster Electric Company and the Ohio Electric Light Association.

MR. MICHAEL DEMUTH, who was one of the first wiremen employed by the Western Edison Company, now the Commonwealth Edison Company, Chicago, Ill., passed away on February 4, 1917. Mr. Demuth was born at Mineral Point, Wis., in 1860, and worked with the Western Edison Company, Chicago, Ill., from 1882 to 1887. During that time he assisted in the wiring of the old Academy of Music in Chicago, which was the first theatre to be lighted by electricity in the United States. Besides this he also took part in many other pioneer installations made during the early days of the Western Edison Company. After leaving the Western Edison Company he accepted the work of installing the first electrical plant in the Brooklyn Navy Yards, N. Y. In June, 1901, he re-entered the employ of the Commonwealth Edison Company, Chicago, Ill., and remained with that company until the time of his death, at the age of 57 years.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

AUGUSTA, ME.—A hearing was held February 21 on a petition of residents of Van Buren to be incorporated into a light and power district. It is proposed to acquire the plant and property of the local electric company. Petitions with 447 names were offered in support of the act, and 357 names were presented in remonstrance.

CASTINE, ME.—At a special town meeting it was unanimously voted to contract with the Penobscot Bay Electric Company, for street lights for a term of 10 years. It is expected that work will begin at once and the lights will be turned on before July 1.

PLYMOUTH, N. H.—The Plymouth Electric Light Company has petitioned the Public Service Commission for authority to raise its rates. A hearing will be held at Concord in the near future.

DANA, MASS.—Negotiations are being carried on between this community and the New England Power Company for street and commercial service. It is proposed by the company to extend a transmission line from Enfield through Greenwich to North Dana.

HARTFORD, CONN.—The Hartford Electric Light Company and the Northern Connecticut Power Company are opposed to a measure which seeks extended powers for the Farmington River Power Company. Representatives of the former hold that it should not be allowed to enter the fields now occupied by these companies. It was stated for the Farmington company that the Stanley Works would use all the energy generated, however.

HEMPSTEAD, N. Y.—The village trustees have decided to enter into a contract with the Nassau Light and Power Company to furnish electric lights for the village streets for the next five years beginning April 30. To date gas has been used for lighting.

NEW YORK, N. Y.—Plans were filed yesterday by the Interborough Rapid Transit Company for the construction of three transformer stations to be erected as follows: At Nos. 122 to 126 Park Row, 49 by 108.3 feet; at Nos. 77 and 79 Murray Street, and at Nos. 150 and 154 East Fifty-seventh Street, each to cost $45,000.

ROOSEVELT, N. Y.—Plans for a municipal light plant for Roosevelt were taken up and discussed when the problem of better lighting was gone into at a regular meeting of the borough council.

TOTTENVILLE, STATEN ISLAND, N. Y.—The Richmond Light & Railroad Company has made formal application for permission to install two new cable lines across Fresh Kill Creek to Lake Island. The lines will be used for the operation of a proposed garbage disposal plant.

ELMER, N. J.—The American Railways Company will install a local electric system. Power service will be furnished from the company's plant at Wilmington, Del.

IRVINGTON, N. J.—Town Commission has approved an appropriation of $14,000 for lighting work. A contract is being arranged with the Public Service Electric Company for a five-year street-lighting service.

McAFEE, N. J.—Bethlehem Steel Company, South Bethlehem, Pa., has awarded a contract for the erection of a one-story, brick and concrete power plant, about 40 by 75 feet, at its local limestone quarries. The station, including coal trestle, will cost $35,000.

NEWARK, N. J.—Board of works has had plans prepared for a garbage incinerator plant to cost $538,000. Investigations are now being made to build a municipal electric plant in conjunction at an estimated cost of $350,000 additional. Morris R. Sherrerd is chief engineer.

NEWTON, N. J.—The Newton Electric & Gas Company has been acquired by the National Utilities Company, Boston, Mass. The new owners are planning extensive improvement in the plant and system.

NORTH BERGEN, N. J.—Bids for the contract for furnishing electric lighting to the Township of North Bergen are scheduled to be received soon. It is expected that the Public Service Corporation will be the only bidder and that a contract will be entered into between them and the township.

PATERSON, N. J.—Edward F. Merrey has been chosen to represent Main Street merchants, in their fight to have the city establish a "white way" system of lighting on Main Street.

PITMAN, N. J.—The borough council has made an appropriation of $3,600 for street lights.

RUTHERFORD, N. J.—The Public Service Electric Company has tendered a proposition for street-lighting at Woodridge.

ALLENTOWN, PA.—The Lehigh Valley Transit Company is making extensive improvements in its overhead transmission and distributing systems between Philadelphia and Slatington. A portion of the work has been completed at a cost of about $100,000. Additional improvements have been inaugurated to represent an expenditure of about $200,000, including work on traction lines and substation leads.

EPHRATA, PA.—Westerhoff Brothers & Napier Company is installing equipment for the electric operation of its silk mill.

HAZLETON, PA.—The Harwood Electric Company, a subsidiary of the Lehigh Navigation Electric Company, is making extensive plans for the installation of electric systems for public and private service in all boroughs and towns within a radius of 25 miles.

LANCASTER, PA.—The Edison Electric Company is planning for the extension of its transmission system from a point near Lititz to Mount Hope.

MILLERSBURG, PA.—A new lighting company has been organized to build and operate a plant for local service. The station is now being equipped for operation.

PHILADELPHIA, PA.—The Theodore Presser Company will build a one-story power station, 70 by 70 feet, at its printing and publishing plant at Yeadon.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad has awarded a contract for a new one-story power plant at its local yards. The structure, including coal pocket, will be 40 by 120 feet.

PHILADELPHIA, PA.—Within the next few weeks arrangements will be made to place under contract, the construction of a power plant for the Philadelphia General Hospital, this being necessary before the erection of the hospital proper can be started. Philip H. Johnson is architect in charge of the work.

PITTSBURGH, PA.—Electrification of the main line of the Pennsylvania Railroad between Altoona and Bellwood, Pa., is under consideration. It is planned to use the water power of the Alleghenies.

RENOVA, PA.—The Renova Edison Light, Heat & Power Company and the Noyes Electric Light Company have merged under the name of the former company with a capital of $200,000. W. J. Murphy is treasurer of the company.

WARWICK, PA.—The French Creek Electric Company has been given a charter for operating in this township. D. J. Knaurer is treasurer of the company which has a capital of $10,000.

WARWICK, PA.—The Warwick Township Light Company has been incorporated to operate in Warwick Township. Its capital is $5,000 and A. E. War is one of the incorporators.

WAYNESBORO, PA.—The Waynesboro Electric Light & Power Company will install a lighting system in the Buena Vista Springs section.

WILKES-BARRE, PA.—The Public Service Commission has granted a franchise to the Wilkes-Barre Light Company, which has been seeking permission for local operation for the past four years. The company will be in competition with the Wilkes-Barre Company, now furnishing service. In accordance with a further ruling of the commission, the contract for street-lighting made recently by the city with the new organization is valid.

NEW CASTLE, DEL.—Fire recently destroyed the engine and pumping plant, and electric transformer station of the Delaware Water Improvement Company, with the loss estimated at $20,000.

WASHINGTON, D. C.—Secretary Baker of the War Department, Secretary Lane of the Interior and Secretary Houston of the Department of Agriculture, are to visit the northwest United States with the object of inspecting suitable power sites for the location of a federal nitrate plant.

CLIFTON, W. VA.—Charleston capitalists have purchased 500 acres of coal land near here, and propose to open a mine, establish an electric power plant to serve this vicinity, and re-open salt workings abandoned some years ago.

FOUNTAIN INN, S. C.—The city will vote on $50,000 in bonds to construct an electric-light, water and sewer systems.

STATESBORO, GA.—It is said that $60,000 in bonds have been voted for improvements to light and water plants and street paving in this city.

DE LAND, FLA.—The Commercial Club of this city has been discussing the question of a lighting system for the business streets of this city. E. L. Hon is manager of the De Land Electric Light Company.

NORTH CENTRAL STATES.

ATHENS, OHIO—A new power house, with coal bunkers, will probably be built at the Athens State Hospital by the board of administration, if plans for the building of a railroad spur to deliver coal and supplies to the institution are carried out.

COLLMBUS, O.—The Columbus Railway, Power & Light Company, has filed an application with the state utilities commission asking for authority to issue securities to the extent of $1,640,379.38. Part of this amount is asked for the purpose of refunding more than $500,000 for improvements made during the past year, and the balance is expected to be spent for betterments and improvements. Included in the improvements is a new power plant south of Columbus along the property of the Hocking Valley Railroad lines.

DAYTON, O.—A power plant and other equipment for the proposed joint tuberculosis sanitarium of Montgomery and Preble counties will be purchased with the proceeds of a bond issue of $90,000 decided upon by the county commissioners at a recent meeting.

OBERLIN, O.—Oberlin is on the road to ownership of a municipal lighting plant, according to plans taken up by the council and the prudential committee of Oberlin College. A committee to investigate the cost of installing such a plant has been appointed.

PIQUA, O.—A committee of citizens is securing the signatures of property owners to an agreement for the installation of a boulevard lighting system on the downtown streets, to be paid for by assessment. The system will be installed by the local electric company.

WALTON, O.—The light plant in this city owned by E. C. Kelley has recently been destroyed by fire and the loss has been estimated at $5,000.

COLUMBUS, IND.—Equipment for the city's new electric-light plant has been delivered and is being installed. Additional street lights will be installed and the new plant will provide for the growth of the city and annexation of suburbs.

GEORGETOWN, IND.—The Town Board has granted to Robert Hurst, of Pekin, a 25-year franchise for an electric-light and power plant, which, under the terms of the franchise, is to be installed within six months. The franchise carries with it

a contract with the Town Board for street lights, and the plant also will furnish light and power for business houses, dwellings and manufacturing establishments. Work on the plant is to be begun at once. An oil engine will be used at the power plant.

MUNCIE, IND.—The electric plant here will, as soon as equipment can be obtained, begin putting in boulevard lights.

ONTARIO, IND.—Arthur L. Cain and associates have incorporated an electric-light company here. The capital stock is $75,000.

BUCKLEY, ILL.—President George W. Bennett, of Urbana, met with the village council in regard to the matter of a franchise for the University Route, through Buckley.

CHICAGO, ILL.—The Business Men's Association of Madison Street has been organized and will work to improve the lighting on Madison street. Address John Z. Vogelsang, 10 South La Salle Street.

KEITHBURG, ILL.—A municipal light plant is under consideration for this city.

OTTAWA, ILL.—At a meeting of the Ottawa city council a five-year contract was let for city lights, the Northern Light & Traction Company being the only bidder and receiving the contract.

LOWELL, MICH.—Lowell voters yesterday decided to bond the village for $40,000 to rebuild the lighting plant.

SHELBY, MICH.—Shelby is about to install a boulevard system of street lighting. Main street will be lighted by the new system a distance of four blocks. The balance of the town will be lighted with 60 candlepower lights.

THREE RIVERS, MICH.—F. Gangl, of the Gangl Construction Company, presented a proposition to light the business places on St. Joseph Street, to the city council.

LANCASTER, WIS.—Franchise has been granted to the Lancaster Light & Power Company for a lighting system including the installation of lamps.

OSCEOLA, WIS.—Plans have been completed for hydroelectric power plant for the Osceola Mill & Elevator Company. The Power Engineering Company, Corn Exchange Building, Minneapolis, Minn., are engineers for the project.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company of Sheboygan, which took over some public utilities in the Fox River Valley, on Friday filed articles of incorporation in the office of the secretary of state. The capital stock of the company is $7,000,000. The incorporators are Raymond H. Smith, Edward J. Furlong and Sylvester W. Thessin.

UNION GROVE, WIS.—William Hardy, who last week had his lighting and water plant destroyed by fire, has closed the deal whereby the Wisconsin Gas & Electric Co. assumes his franchise and business at this city. Work on extending wire from Corliss will be started at once.

WESTFIELD, WIS.—A deal was made this week between W. H. Moss and Gust Dahlke of Neshkoro whereby the latter becomes the owner of the Westfield Milling & Electric Light Plant.

DEER RIVER, MINN.—Manager W. A. Everton of the Everton Electric Light & Power Company, whose plant here was burned at an estimated loss of $10,000, is arranging a new plant to be erected in about four months. A temporary plant may be installed at the ruined place, or a dynamo may be placed in the power house of the Northern Veneer Company for the present.

EMMONS, MINN.—Plans are being considered for installing a municipal electric plant. Earl D. Jackson, Capital Bank Building, St. Paul, is consulting engineer.

MINNEAPOLIS, MINN.—The Dan Patch line, which operates by gasoline motorpower, will be electrified, if a plan completed recently is adopted when the company is financially reorganized, probably within the next 90 days. M. H. Boutelle, is attorney for the company.

NORTHOP, MINN.—The village contemplates installing an electric-lighting system in the near future.

RUTHTON, MINN.—Bond issue for electric-lighting system was carried at an election. G. S. Everts is village clerk.

DAVENPORT, IOWA—The capital stock of three tri-city public utility corporations, owned by the Tri-City Railway & Light Company will be increased by a total of $595,000. B. J. Denman of Davenport is vice-president and manager of the company.

NEVADA, IOWA—The Iowa Railway & Light Company has contracted to erect a high tension electric line from the plant in this city for a distance of 11 miles northwest of here with Dayton Lake Amusement park as the terminal. Electricity for light and power will be furnished for the park as well as the farmers along the line. Negotiations are also under way to extend the line through Gilbert to Story City.

SPENCER, IOWA.—Plans for Spencer's new $60,000 municipal electric-light and power plant were approved at a special meeting of the city council held recently.

SUMNER, IOWA.—The Sumner Electric Light & Power Company sold to the Cedar Valley Electric Company the past week, the transfer taking place immediately. Mont Wall has been engaged as local manager.

FULTON, MO.—Resolutions have been adopted for the purchase of private electric meters and the furnishing of meters hereafter by the city.

HANNIBAL, MO.—The Illinois Traction Company has taken over the North Missouri Power Company and it is said that the new owners of the North Missouri company will probably proceed to build an interurban line in this section of the state.

KANSAS CITY, MO.—A site has been purchased by the Kansas City Light & Power Company on which a $7,000,000 power plant will be built. John H. Lucas, president of the company, said plans were now being prepared by the Lundy & Sargent Engineering Company, of Chicago.

POPLAR BLUFF, MO.—The city will issue $10,000 in bonds for an electric-light system.

AGRA, KANS.—Election will be held April 2 to vote bonds in the sum of $8,000 for the purpose of supplying said city with electric lights. E. L. Keckley is city clerk.

HOXIE, KANS.—The city's municipal plant is nearly completed. The cost will be about $18,000 and the motive power will be a double-unit system using oil engines. The completion of the plant will undoubtedly call for other electrical work to be done in connection with the consumers of the electricity generated by the new plant.

McPHERSON, KANS. — Improvements are to be made to the power plant for the purpose of improving the water and light system. Address J. W. Jenkins, city commissioner.

OMAHA, NEB.—The Alamo Farm Light Company, has been incorporated with a capital of $300,000 for the purpose of operating electric lighting plants. Address F. L. Tubbs, president.

DATES AHEAD.

Wisconsin Electrical Association. Annual meeting, Hotel Pfister, Milwaukee, Wis., March 15-16. President, W. E. Haseltine, Ripon, Wis.

Minnesota Electrical Association. Annual convention, St. Paul, Minn., March 20-22. Secretary, Fred A. Otto.

National Association of Electrical Inspectors. Biennial convention, New York, March 27-29. Chairman committee on arrangements, Alfred E. Braddell, Sprague Electric Co., New York City.

Tri-State Water and Light Association of the Carolinas and Georgia. Annual convention, Macon, Ga., April 17-19. Secretary, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., April 26-28. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

National Fire Protection Association. Annual meeting, Washington, D. C., May 8-10. Secretary-treasurer, Franklin H. Wentworth, 87 Milk Street, Boston, Mass.

Arkansas Association of Public Utility Operators. Annual convention, Pine Bluff, May 16-18. Secretary-treasurer, R. B. Fowles, Pine Bluff Company, Pine Bluff, Ark.

Missouri Association of Public Utilities. Annual convention, aboard Steamer *Quincy* en route from St. Louis, May 17-19. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

Electrical Supply Jobbers' Associations. Semi-annual meeting, Homestead Hotel, Hot Springs, Va., May 22-24. Secretary, Franklin Overbagh, 411 South Carolina Street, Chicago, Ill.

National Electric Light Association, Iowa Section's annual convention, Des Moines, Iowa, May 24-25. Secretary, L. E. Caldwell, Iowa City, Iowa.

National Electric Light Association. Annual convention, Atlantic City, N. J., May 29-June 1. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York City.

American Institute of Electrical Engineers. Annual convention, Hot Springs, Va., June 26-29. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York City.

SOUTH CENTRAL STATES.

MONTICELLO, KY. — The Monticello Electric Light & Power Company, recently reported as having purchased a mill site, is asking for prices on a water turbine for a 50-foot head, to develop 150 horsepower, direct connected to 6,600-volt generator of 100 kilowatts, with exciter and switchboard.

MURRAY, KY.—The issue of $20,000 5-per cent city light bonds was sold recently. The city will take over the old electric plant April 1.

NEWPORT, KY.—Plans are being prepared by Engineer G. Hornung, Woolsack Building, for an electric-light plant in this city.

PADUCAH, KY.—To take up their work of compiling data and furnishing plans for the city for the enlargement of the city light plant and converting it into a municipal light and power plant, engineers F. G. Proutt and A. L. Dabney, of Memphis, visited this city. They will make a complete survey of the city figuring the expense of installing new machinery in the light plant and stringing wires.

TOMPKINSVILLE, KY.—The Tompkinsville Electric Light & Ice Company's plant was totally destroyed by fire. Loss estimated at $8,000. Address manager J. B. Brown.

MANCHESTER, TENN.—The Manchester Electric Light & Power Company has been incorporated with capital stock of $5,000 by T. H. Webb, J. B. Wall and others.

LECOMPTE, LA.—The city will erect an electric-light and power plant in connection with the water works. It is proposed to construct about 15 miles and install 2,300-volt, 60-cycle, 3-phase alternating-current lines with low tension distribution of 115 volts. Bids will be received within the next 30 days.

ARDMORE, OKLA.—The holding company which is known as the Consumers Light & Power Company, has been recently organized with Ardmore as headquarters. This company will own and operate the light and ice plants in this city, the ice and gas plants at Ringling, the gas plant at New Healdton and will build an electric light plant at Ringling. An electric light and power plant will be built at Waurika.

BARTLESVILLE, OKLA.—The Mid-Co Gasoline Company is now building a $2,000,000-plant near here which will furnish power, heat and light for the oil fields of this vicinity. It has also been stated that the company will build other plants in the Oklahoma oil fields, in the near future.

BILLINGS, OKLA.—An election will be held to vote on bonds for an electric-light plant for Billings.

LAWTON, OKLA.—The Grandfield ice and power plant has been destroyed by fire. The loss is estimated at $12,000.

OKLAHOMA CITY, OKLA.—The United States Black Leg Serum Company, U. E. Marney, 714 W. Main St., manager, contemplates installing a small electric plant.

BROWNWOOD, TEX.—Through the cooperation of the Chamber of Commerce and the Retail Merchants Association the Texas Power & Light Company has succeeded in an effort to install a white-way and window lighting system which when completed will consist of 500 lamps of some 50,000 candlepower.

DALLAS, TEX.—The city commission will make a survey of the electric-light system of Dallas and the data which is thus obtained will be made a basis for extensive improvements to the system as one of the requirements of the proposed new franchise to be granted the Dallas Electric Light & Power Company.

DENISON, TEX.—It has been announced that as soon as the United States Bureau of Indian affairs approves the proposal of the Texas Power & Light Company and the Texas Electric Railway Company to build an electric power plant on the north bank of the Red River in Oklahoma, five miles north of Denison, the work of construction will be started. The proposed plant will cost about $750,000. The Legislature of Oklahoma has already given authority on the part of the state for the building of the plant, but the acquiesence of the Bureau of Indian affairs is necessary before undertaking the project.

DUBLIN, TEX.—The Texas Power & Light Company of Dallas will rebuild the electric power and light plant here which it recently purchased.

KAUFMAN, TEX.—The local electric plant has been purchased by the Texas Power & Light Company and a franchise granted the company by this city. The old plant will be dismantled and service rendered by means of a transmission line from Trinity Heights and Jenkins via Forney and Terrell.

SHERMAN, TEX.—Active work has started on the Jenkins-Payne-Sherman-Denison-Bonham transmission lines which are being built by the Texas Power & Light Company. These lines will run from Jenkins to Payne and Sherman, a distance of about 60 miles, thence to Denison, a distance of 10 miles and also to Bonham from Payne, a distance of 23 miles. The line from Payne to Bonham will be a new line connecting up the Paris-Bonham-Honey Grove transmission district with the north end of the central Texas transmission district of the company. Practically all towns in this district will then have available service from two or more sources.

WAXAHACHIE, TEX.—The Texas Power & Light Company has started work on the enlargement of its substation at this place. New foundations are being put in for all transformers. The 11,000-volt substation structure is being changed and all 11,000-volt lines out of Waxahachie will be provided with oil switches.

WESTERN STATES.

COLORADO SPRINGS, COLO.—A cluster lighting system is to be erected on East Pikes Peak Avenue in this city. B. M. Lathrop is superintendent of the company which intends to stand the financial end of making the installation.

CASA GRANDE, ARIZ.—The city council awarded the contract for building the city electric-light and water plant to Schweitzer Machine Company on their bid of $25,029.

NOGALES, ARIZ.—A committee of the Chamber of Commerce has been appointed to investigate a plan for lighting.

ST. JOHNS, ARIZ.—Thomas W. Carraway has been awarded the contract for putting in the power plant for the Nebo Electric Light & Power Company.

TOMBSTONE, ARIZ.—J. Downey, who was recently granted an electric-light plant franchise will start construction work on the new plant in the near future and $15,000 will be spent in the construction work which will include a street lighting system.

TUCSON, ARIZ.—An electric-light plant will be built on the Stratton mining property as part of the development work required for obtaining claim patents from the government.

BREMERTON, WASH.—The consolidation of Bremerton, Charleston and Manette and the construction of a municipal light plant were among the plans for Bremerton's future development discussed at the meeting of the city council recently. The council went on record as favoring the building of a light plant.

INDEX, WASH.—The city has voted $20,000 in bonds for an electric power and light plant in this city and bids will soon be received.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has applied for a 50-year franchise from the county.

TACOMA, WASH.—The Wheeler-Osgood Company will soon begin the construction of a new power plant on the tide lands at a cost of between $30,000 and $40,000 and 1,800 horsepower will be generated.

ALBANY, ORE.—The city council has asked the Oregon Power Company for a price on the light system owned by them in Albany.

MARSHFIELD, ORE.—An election will be called soon to decide on bonding the city for an electric-lighting plant.

PENDLETON, ORE.—The city council is investigating the feasibility of putting in a municipal electric plant in connection with the water system.

ARCADIA, CAL.—Ornamental lights will be installed from the Santa Fe Railway right-of-way to Anita Avenue. Fourteen ornamental concrete lighting standards will be used.

FILLMORE, CAL.—The city trustees have decided to interview the property holders in regard to the installation of ornamental lights on Central Avenue between South and Main Streets.

HANFORD, CAL.—The Mount Whitney Power & Electric Company has been granted a 50-year franchise in King County.

LOS ANGELES, CAL.—The city council has been petitioned to install an ornamental lighting system on Sierra Bonita Avenue between Hawthorne Avenue and Sunset Boulevard.

LOS ANGELES, CAL.—Details for the building of a power dam in the Grand Canyon of the Colorado River are completed. The plant will furnish power for the mining projects of three states and considerable electrical equipment will be needed by the consumers of this power.

LOS ANGELES, CAL.—The city council has withdrawn all steps toward holding a charter amendment March 8 to vote on the proposed purchase of the distributing systems of the two power companies. In place of the discarded scheme the city council will submit three propositions to the vote of the people at some future date. These are: Shall the city purchase the distributing systems of the two companies? Shall the city wholesale its power to the power companies? Shall the city parallel existing distributing systems?

MARTINEZ, CAL.—The ship-building plant of James F. Robertson at Benicia is to be rebuilt with electric power to supplant the gasoline engines.

RICHMOND, CAL.—The Merchants Association of this city has started a campaign to have electroliers installed in the business district.

SACRAMENTO, CAL.—The Nevada Valleys Power Company will erect a 2,500-horsepower plant below Vista on the Truckee River. Work will be started as soon as the weather permits.

SAN LUIS OBISPO, CAL.—A committee consisting of G. A. Gawman, R. W. W. Rider, H. L. Kemper, D. R. Riley and H. C. Daw have been inspecting Fresno's street lighting system, preparatory to recommending a lighting system for their city.

VACAVILLE, CAL.—The Vallejo Electric Light & Power Company has filed application for franchise to operate in Solano County.

VENTURA, CAL.—Charles Chrisman has made application for authority to furnish this city with electricity.

Proposals

CONSTRUCTION.—The Board of Supervisors, Fresno, Cal., will receive bids until March 14 for the construction of Caruthers Lighting District.

LIGHTING SYSTEM.—The Board of Supervisors, Modesto, Cal., has asked for bids for furnishing equipment and electricity for lighting the streets of the city.

SWITCHBOARD.—Sealed proposals will be received by the city council Detroit, Minn., March 19, 1917, for the furnishing and installation of one switchboard complete, in accordance with the plans and specifications of Charles L. Pillsbury Company, engineers, 805 Metropolitan Life Bldg., Minneapolis, Minn.

NAVY ELECTRICAL SUPPLIES.—Bids will be received by the Bureau of Accounts and Supplies, Navy Department, Washington, D. C., for supplies at the following naval stations: Philadelphia, Pa., Schedule No. 786, 9,300 fuse plugs; Brooklyn, N. Y., Schedule No. 786, 520,000 feet of bell wire and 47,000 feet of twin-conductor wire and Schedule No. 784, 125,000 feet of single, rubber-covered wire.

ELECTRICAL EQUIPMENT. — Electrical and power equipment will be required in the construction of the women's receiving building and the power house connected with it, to be built by the New Longview Hospital Building Commission, Cincinnati, O. Plans have been prepared by Elzner & Anderson, architects, Ingalls Building, Cincinnati, and may be had of the architects or at the office of the commission in the court house. Bids will be received until noon, March 21.

AUTOMATIC SIGNAL SYSTEM.—Sealed bids will be received by the city manager, Springfield, O., at Room 1, City Building, March 14, 1917, for the delivery and installation complete of a 40-call box automatic police signal system, in accordance with the general specifications therefor, on file in the office of the city manager. Each bid shall likewise be accompanied by detailed drawings and specifications furnished by the bidder, and shall be accompanied by a bond in the sum of $1,000 with sureties to the approval of the city manager, Chas. E. Ashburner.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. Rate Per cent	Bid Feb. 26	Bid Mch. 5
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	----	23	24
Adirondack Electric Power of Glens Falls, preferred	6	82	81
American Gas & Electric of New York, common	10+extra	136	136
American Gas & Electric of New York, preferred	6	51	51
American Light & Traction of New York, common	----	357	355
American Light & Traction of New York, preferred	6	112	111
American Power & Light of New York, common	4	83	83½
American Power & Light of New York, preferred	6	91	91½
American Public Utilities of Grand Rapids, common	----	35	38
American Public Utilities of Grand Rapids, preferred	6	90	68
American Telephone & Telegraph of New York	----	124⅞	125½
American Water Works & Elec. of New York, common	----	11¼	11⅜
American Water Works & Elec. of New York, particip	7	24	25
American Water Works & Elec. of New York, first preferred	----	69	69
Appalachian Power of Bluefield, common	----	6	7
Appalachian Power of Bluefield, preferred	7	37	39
Cities Service of New York, common	6+extra	287	296
Cities Service of New York, preferred	6	90	90
Commonwealth Edison of Chicago	8	135	134
Comm. Power, Railway & Light of Jackson, common	4	57	57
Comm. Power, Railway & Light of Jackson, preferred	6	80	80
Federal Light & Traction of New York, common	----	12	14½
Federal Light & Traction of New York, preferred	----	51	50
Illinois Northern Utilities of Dixon	6	82	82
Middle West Utilities of Chicago, common	2+2 extra	58½	58½
Middle West Utilities of Chicago, preferred	6	78½	77½
Northern States Power of Chicago, common	7	100	100
Northern States Power of Chicago, preferred	7	98½	99
Pacific Gas & Electric of San Francisco, common	5	64	63¼
Pacific Gas & Electric of San Francisco, preferred	6	93	92
Public Service of Northern Illinois, Chicago, common	7	105	105
Public Service of Northern Illinois, Chicago, preferred	6	98½	99
Republic Railway & Light of Youngstown, common	4	44½	41
Republic Railway & Light of Youngstown, preferred	6	73½	73
Standard Gas & Electric of Chicago, common	----	11	12
Standard Gas & Electric of Chicago, preferred	6	39	38
Tennessee Railway, Light & Power of Chattanooga, common	----	8	7½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	38	40
United Light & Railways of Grand Rapids, common	4	46½	48
United Light & Railways of Grand Rapids, preferred	6	76½	76
Western Power of San Francisco, common	----	17½	17½
Western Power of San Francisco, preferred	6	65	65
Western Union Telegraph of New York	5+extra	93¾	94
Industrials—			
Electric Storage Battery of Philadelphia, common	4	63	64⅜
General Electric of Schenectady	8	161½	165
National Carbon of Cleveland, common	8	†300	†300
National Carbon of Cleveland, preferred	7	†130¼	†130¼
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	49	50
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	69	69

†Last Sale.

Financial Notes

The January statement of the gross earnings of the Commonwealth Power, Railway & Light Company, Grand Rapids, Mich., shows an increase of 14.93 per cent, the total being $1,617,718.57. The net earnings were $779,201.22, or a gain of 3.48 per cent. For the 12 months previous, the gross earnings were $17,172,733.44, or an increase of 16.38 per cent, while the net earnings were $8,614,212.13, or a gain of 11.55 per cent.

Utah Power & Light Company reports gross for January $425,654, compared with $358,629 for corresponding period 1916; net $227,096, compared with $193,314; net after charges, $122,713, compared with $92,577; 12 months' gross, ended January 31, $4,379,113, compared with $3,664,745 for 1916; net, $2,261,421, compared with $1,783,128; net, after charges, $1,106,373, compared with $814,554.

The annual report of the Dayton (O.) Power & Light Company for the year ended December 31, 1916, is as follows:

	1916.	1915
Gross earnings	$1,613,873	$1,098,065
Operating expenses	999,961	579,581
Net earnings	613,912	518,483
Other income	6,618	12,987
Total income	620,531	531,471
Fixed charges	235,963	217,932
Net income	348,567	313,538
Div. on prfd. stock	175,938	128,346
Surplus	208,629	185,192

The increase of 72.5 per cent in operating expenses was brought about chiefly through the high cost of coal and materials.

Alabama Power Company reports January gross, $158,328, increase $49,106; operating expenses and taxes, $47,582, increase $10,038; net, $110,746, increase $39,068; 12 months' gross, ended January 31, $1,565,059, increase $485,179; operating expenses and taxes, $576,384, increase $162,878; net, $988,675, increase $322,301.

Publication of the annual report of the Walkerville (Mich.) hydroelectric commission for last year shows that the municipal lighting and power venture had a balance on the credit side of $12,463.06. After a depreciation charge of $3,773.06 was deducted, a net surplus of $8,698 remained, as against the gross surplus of $5,641 in 1915. Total earnings for the year were $113,403.27, an increase of $49,000 over the previous year. The earnings were made up as follows: Domestic light, $18,813.06; commercial light, $12,104.72; power, $77,003.07; street lighting for Walkerville, $3,828.49; merchandise, $423.93; street lighting, Ford and Tecumseh, $1,221.

Electrical Patents Issued February 27, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,217,135. Fastening-Clip for Wire-Terminals. C. E. Beck, Detroit, Mich., assignor to the Beck-Frost Corporation. For securing to binding posts, etc.

1,217,143. Connecting Plug. A. Bouchery, Brooklyn, N. Y. Structural details.

1,217,148. X-Ray Apparatus. E. W. Caldwell, New York, N. Y. Details of apparatus fed from three-phase transformers.

1,217,149. X-Ray Apparatus. E. W. Caldwell. Details of apparatus employing a series of more than three interchangeable, polyphase, high-potential transformer units.

1,217,150. Power-Transmission System. E. D. Cam'bell, St. Louis, Mo. Gearing for axle-driven dynamos.

1,217,160. Automatic Telephone-Line-Finder System. B. G. Dunham, assignor to Western Electric Co., New York, N. Y. Telephone testing system.

1,217,168. Telephone-Exchange System. C. L. Goodrum, assignor to Western Electric Co. Automatic.

1,217,170. Coin-Testing Attachment for Coin-Controlled Mechanisms. A. D. Grove, assignor to Autosales Gum & Chocolate Co., New York, N. Y. For eliminating magnetic disks.

1,217,175. Burglar-Alarm. A. O. Hilley, Waco, Tex. Has circuit controlled by door or window.

1,217,180. Door-Controlling and Signaling System. M. M. Huebsch, Chicago, Ill. Door-unlocking system for apartment houses, etc.

1,217,187. Synchronous Motor. A. Kimble and J. D. Nies, assignors to Kimble Electric Co., Chicago, Ill. Has a starting field magnet.

1,217,223. Automobile-Signal. S. F. Sexton, Detroit, Mich., assignor of one-half to J. A. Miller, Toledo, O. For mounting on fender.

1,217,226. Electrically-Heated Embossing-Base. J. H. Schussler, assignor to Acme Printing Appliance Co., Chicago, Ill. Manner of mounting embedded resistor.

1,217,229. Electric Air-Heating System. E. J. Smith, assignor to Peter Smith Heater Co., Detroit, Mich. Control of system having fan blowing air through electrically-heated conduit.

1,217,241. Alarm Signaling Apparatus. O. H. Tracy, Minneapolis, Minn., assignor to Volunteer Fireman Signal Co. Automatic telephone signaling machine.

1,217,244. Automatic-Starter and Lighter for Automobiles. W. A. Turbayne, assignor by mesne assignments to U. S. Light & Heat Corp., Niagara Falls, N. Y. Dynamo rapidly rotates member, connection of which with engine flywheel is electrically controlled.

1,217,254. Deep-Sea-Salvage-Recovering Apparatus. G. W. Winslow, Chicago, Ill. Pressure-resisting casing contains electrical apparatus and has conduit for conductors and air pipe extending to scow.

1,217,255. Telephone System. C. S. Winston, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Combined manual and automatic system.

1,217,289. Cartridge-Fuse. A. L. Eustice, Chicago, Ill., assignor to Economy Fuse & Manufacturing Co., Chicago, Ill. Enclosed fuse adapted to melt at ends.

1,217,301. Maximum-Demand Recorder. C. I. Hall, assignor to Chicago Electric Meter Co., Chicago, Ill. Details of electricity measuring and recording mechanism.

1,217,302. Electricity-Measuring Instrument and Timing Device Therefor. C. I. Hall, assignor to Chicago Electric Meter Co., Chicago, Ill. Maximum demand instrument comprising electrolytically actuated devices.

1,217,306. Electric-Furnace-Wall Construction. I. Hechenbleikner, assignor to Southern Electro-Chemical Co., New York, N. Y. Details of water-cooled structure.

1,217,310. Electric Self-Winding Clock. E. A. Hummel, assignor to A. L. Haman, St. Paul, Minn. Mechanism operated by electromagnet.

1,217,315. Insulator. H. Kendig, Pittsburgh, Pa. Two-part cleat.

1,217,317. Trolley-Switch. F. W. Kulicks, Philadelphia, Pa. Trolley-operated circuit-closer.

1,217,321. Electric-Bath Apparatus. J. D. Lowe, Fort Worth, Tex. Structure of electrode.

1,217,348. Variable Electrical Apparatus. O. F. Rothen, assignor to F. Lowenstein, Brooklyn, N. Y. Mechanism for moving a contact along a spiral conductor.

1,217,358. Electrical Attachment for Self-Playing Musical Instruments. A. M. Steinert, Providence, R. I. Self-playing instrument controls auxiliary instrument through contacts controlled by note sheet.

1,217,359. Auxiliary-Percussion-Instrument Attachment for Self-Playing Musical Instruments. A. M. Steinert. Arrangement of rheostats, etc., in above.

1,217,360. Shoe-Toe Moistening and Heating Apparatus. L. E. Stocker, Saugus, Mass. Electrically heated.

1,217,380. Electric Water-Heater. W. C. Williams, Winnipeg, Manitoba, Can. Electrically-heated water tube boiler.

1,217,398. Metal Conduit-Moulding. W. A. Bonnell, Brooklyn, N. Y. Details of structure for enclosing conductors.

1,217,413. Apparatus for the Control of Electric Motors. E. R. Cox, assignor to the Union Switch & Signal Co., Swissvale, Pa. Braking is controlled by frequency.

1,217,420. Antiglare Means for Headlights. A. C. Davis and D. L. Primrose, Baltimore, Md. Comprises arrangement of a series of thin horizontal plates at front of casing.

1,217,426. Measured-Service Telephone System. J. Erickson, assignor to Automatic Electric Co., Chicago, Ill. Prepayment system.

1,217,431. Method and Apparatus for Electrically Heating Metal. W. E. Foley, assignor to Dollar Savings and Trust Co., Youngstown, O. Arc apparatus has a rotating disk as one electrode.

1,217,432. Process for Extracting Potash and Aluminum from Alunite. P. J. Fox, Washington, D. C. The aluminum is recovered by electrolysis.

1,217,440. Electric Switch. G. B. Gray, assignor to Automatic Train Control & Signal Co., Pittsburgh, Pa. Manner of controlling fluid for operating a pressure responsive circuit controller.

1,217,445. Telephone Attachment. F. Hein, New York, N. Y. Extensible receiver support.

1,217,452. Lightning-Arrester. R. P. Jackson, assignor to Westinghouse Electric & Mfg. Co., Pittsburgh, Pa. Wire hanger has series of spark gaps in ground connection.

1,217,453. Static Protective Device. R. P. Jackson, assignor to Westinghouse Electric & Mfg. Co. Structure of choke coil.

1,217,468. Electrode-Holder. J. C. Lincoln, Cleveland, O. Handled device for gripping carbon electrode.

1,217,469. Time-Element Relay. A. J. Loguin, assignor to Allis-Chalmers Mfg. Co. Details of dash pot device for retarded circuit breaker.

1,217,472. Telephone-Exchange System. J. L. McQuarrie and F. H. Loveridge, assignors to Western Electric Co. Call distributing system.

1,217,473. Control Apparatus. D. H. Mace, assignor to Westinghouse Electric & Mfg. Co. Liquid rheostat.

1,217,477. Telephone-Exchange Supervisory System. T. C. Martin, assignor to Automatic Electric Co., Chicago, Ill. Arrangement of cord circuits with automatic connectors.

1,217,482. Self-Regulating Dynamo-Electric Machine. A. H. Midgly and C. A. Vandervell, Acton Vale, England. Reversible, variable speed, direct current machine.

1,217,483. Transmitting Apparatus for Wireless Telegraph Stations. T. B. Miller, assignor to Wireless Instrument Co., Seattle, Wash. Details of circuits and apparatus.

1,217,484. Magneto Ignition System for Internal-Combustion Engines. J. L. Milton, assignor to Motor Ignition & Devices Co. Details of circuits and apparatus.

1,217,489. Socket-Cover. Harry Northwood, Wheeling, W. Va. Combined socket cover and shade support.

1,217,491. Extensible-Support. W. B. Oliver, Collingswood, N. J. For telephones.

1,217,497. Electric Furnace. C. A. Pfanstiehl, Waukegan, Ill., assignor to Pfanstiehl Co. Porous refractory tube has electric heating element within it supporting the treated articles, and a body of hydrogen confined about it.

1,217,508. Insulator. W. Schaake, assignor to Westinghouse Electric & Mfg. Co. Strain insulator.

1,217,510. Telephone Trunking System. M. Schwartz, assignor to Automatic Electric Co., Chicago, Ill. Automatic.

1,217,511. Means for Minimizing Inductive Interference. C. F. Scott, assignor to Westinghouse Electric & Mfg. Co. Between trolley lines and telephone or telegraph circuits.

1,217,513. Switching Apparatus. K. A. Simmons, assignor to Westinghouse Electric & Mfg. Co. Fluid operated device.

1,217,514. Controlling Apparatus. K. A. Simmons, assignor to Westinghouse Electric & Mfg. Co. Liquid rheostat.

1,217,516. Transmitting Apparatus for Wireless-Telegraph Stations. F. G. Simpson, Seattle, Wash. Arrangement of charging, trigger and oscillation circuits.

1,217,517. Radio Telegraph and Telephone System. F. G. Simpson. Comprises an oscillation circuit with a spark gap connected to nodal points of potential.

1,217,523. Alarm-Clock and Attachment Therefor. J. Stewart, North Geelong, Victoria, Australia. Arrangement of contacts operated by clock hands.

1,217,529. Electric Power Transmission. J. G. P. Thomas, assignor to Thomas Foreign Patents Limited, London, Eng. Gearing for electro-mechanical transmission.

1,217,530. Automatic Train-Controlling System. G. O. Thurber, Pittsburgh, Pa. Air brake valve is electromagnetically controlled by normally closed circuit.

1,217,534. Connector for Electrical Apparatus. S. Trood, assignor to Westinghouse Electric & Mfg. Co. Terminal plug.

1,217,548. Telephone System. C. A. Randell, Boston, Mass. Detailed arrangement of transmitter and receiver circuits.

1,217,557. Electric Clock. J. G. Blessing, assignor to E. Keith, Hinsdale, Ill. Structure of magnetically operated ratchet and pawl mechanism.

1,217,558. Signal System and Controlling Therefor. F. E. Boardman, Memphis, Tenn. Circuit and contact arrangement comprising

a number of schedule shafts driven at different speeds.

1,217,566. Distributor for Electric Ignition System. J. F. Cavanagh, assignor to The Connecticut Telephone & Electric Co., Inc., Meriden, Conn. Structure of housing for vertical unit.

1,217,573. Separators for Storage-Battery Couples. W. A. Crowdus, assignor to J. P. Mentzer, Chicago, Ill. Consists of a flexible absorbent sheet of pulverized lignin from which most of the carbonizing constituents have been removed.

1,217,578. Material for Electrical Resistances and the Like. W. B. Driver, Newark, N. J. Alloy of copper and manganese with about 5 per cent tin.

1,217,582. Electric-Light Shade. G. Ellis, Irvington, and W. Mendel, Newark, N. J. For socket attachment.

1,217,585. Method for Measuring Distance. R. A. Fessenden, assignor to Submarine Signal Co., Waterville, Me. Electrical impulses are transformed into sound for a predetermined period, the received sound is retransformed and time of receipt of first impulses after beginning of period is noted.

1,217,604. Terminal for Electric Conduits. F. I. Johnson, Warren, R. I. Structure of head permitting passage of wires.

1,217,613. Automatic Magnetic Separator for Mills. H. O. Little, Bridgewater, Mass. Material is magnetically directed into or diverted from a port in a chute.

1,217,618. Time-Controlled Electric Switch. F. A. Mechau, assignor to J. Biddle, Washington, D. C., and W. C. Marrow, Narragansett Pier, R. I. Clock governed device.

1,217,628. Signaling Device. J. F. Pereti, Trenton, N. J. Structural details of circuit closer.

1,217,631. Sanding Device for Storage-Battery Locomotives. C. A. Pratt, assignor to Goodman Mfg. Co., Chicago, Ill. Structural details.

1,217,643. Electrical Water-Purifying Apparatus. G. J. Schneider, Detroit, Mich. Immersion device comprising spaced, noncorrodible electrodes.

1,217,644. Vehicle-Light. E. W. Schurman, Central Bedeque, Prince Edward Island, Canada, assignor of one-half to A. M. Graham, Boston, Mass. Battery lamp is mounted on shaft of horse-drawn vehicle.

1,217,670. Automatic Electric Generating Plant. C. B. Walker, Solihull, Eng. Dynamo and battery system in which the cells are automatically cut in and out.

1,217,688. Electric Switch. C. A. Bates, assignor to The Bryant Electric Co., Bridgeport, Conn. Push button, snap.

1,217,701. Circuit-Closer for Drip-Pan Alarms. H. B. Brunelle and E. Brunelle, Turners Falls, Mass. Structural details.

1,217,702. Electric Tractor. G. B. Bulley, assignor to Mercury Mfg. Co., Chicago, Ill. Details of structural arrangement including the mounting of the motor and storage battery.

1,217,707. Pull-Switch for Electric Mine-Signals. C. Clausen, Bisbee, Ariz. Structural details.

1,217,715. Electric Sign. S. G. Crane, assignor to Toledo Scale Co., Newark, N. J. Details of device having contacts controlled by an expansible conductor.

1,217,719. Current-Lock for Automobiles. W. J. Dorgan, Grantwood, N. J. Mechanism requiring special arrangement of interlocking parts to establish current connection.

1,217,720. Cut-Out for Electric Instruments, Glow-Lamps, and the Like. A. G. Downes, Croyden, Eng., assignor of one-half to John Venning, London, Eng. For lamps on series, low pressure circuits.

1,217,738. Battery. J. M. Flannery, Pittsburgh, Pa. Has ionizer, consisting of a sheet of celluloid carrying radio active material incorporated therein.

1,217,739. Battery. J. M. Flannery. Ionizer is a sheet having a radio active coating.

1,217,741. Fuse-Holder. O. E. Forrest, assignor to General Electric Co., Schenectady, N. Y. Hand implement for removing enclosed fuses.

1,217,751. Permutation Switch-Lock. M. L. Greenstreet and G. Moulder, Lebanon, Mo., assignor of one-third to A. G. Hoppeck, Lebanon, Mo. Controls connection of rotary handle on cover with movable switch member.

1,217,753. Auxiliary Indicating Device for Cash-Registers. O. E. Groshell, Salt Lake City, Utah. Keys electrically control drop plates.

1,217,759. Direction-Indicator for Vehicles. C. G. Hamilton, Seattle, Wash., assignor of one-half to C. Sturtevant, Seattle, Wash. Electrically operated pointer.

1,217,775. Electric Incandescent Lamp. H. Kiehl, Chicago, Ill. Arrangement of filament.

1,217,784. Spark-Plug. F. R. La Plante, Gunnison, Colo. Details.

1,217,787. Railway-Traffic-Controlling Apparatus. L. V. Lewis, assignor to the Union Switch & Signal Co., Swissvale, Pa. Air brake control valves are electrically operated through ramp rail.

1,217,815. Drill, Hammer and Motor-Case Combined. W. S. Payne, University Place, Neb. Mounting and gearing of motor on portable tool.

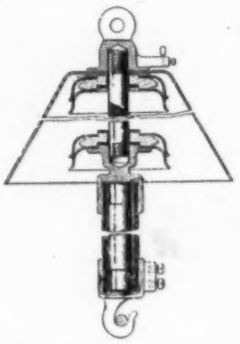
1,217,827. Capacity-Meter. B. P. Romain, assignor to Weston Electrical Instrument Co., Newark, N. J. Structure and arrangement of coils of indicating instrument.

1,217,829. Lamp-Lock. J. Sachs, assignor to Hart & Hegeman Mfg. Co., Hartford, Conn. For preventing unscrewing from socket.

1,217,830. Lock for Incandescent-Lamp Structures and the Like. J. Sachs, assignor to Hart & Hegeman Mfg. Co. Modification of above.

1,217,831. Electrical Connecting Member. J. Sachs, assignor to Hart & Hegeman Mfg. Co. Structure of attachment plug.

1,217,841. Vehicle Head-Lamp. O. R. Sell, Colorado Springs, Colo. Has special adjustable lamp mounting.



1,217,452.—Lightning Arrester.

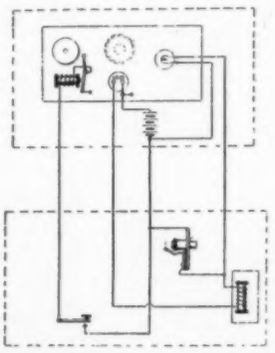
1,217,843. Automatic Electric Winder for Spring-Motors. W. G. Shelton, New York, N. Y. Relates to gearing and control of motor.

1,217,844. Safety Fire-Alarm Box. L. Shubatt, Centerville, Iowa. Details of device having handcuff for gripping operator.

1,217,858. Electric Regulation. J. L. Creveling, Auburn, N. Y. Arrangement of shunt field and commutating windings.

1,217,873. Electric Insulator. N. Marshall, West Newton, Mass. Comprising asbestos impregnated with decomposition and reaction products of emulsion of sodium silicate and raw linseed oil.

1,217,877. Rectifier. E. J. Pace, Los Angeles, Cal. Specially wound motor with



1,217,180.—Door-Controlling and Signalling System.

commutator on collector rings connected to armature.

1,217,882. Indicator-Alarm. C. Roma, Memphis, Tenn. Float controlled indicator for tanks controls alarm circuit.

1,217,890. High-Voltage Insulating-Bushing. C. Le G. Fortescue, assignor to Westinghouse Electric & Mfg. Co. Comprises convolutions of insulating material with sheet material interposed between them, including strands which lend conductivity in one direction only.

PATENTS EXPIRED.

The following United States electrical patents expired on March 6, 1917:

644,562 and 644,563. Electric Arc Lamp. T. E. Adams, Cleveland, O.

644,565. Transformer. E. Arnold, Carlsruhe, Germany.

644,591. Electric Drill, etc. W. P. Freeman, New York, N. Y.

644,594. Telephone System. J. W. Gore, Chapel Hill, N. C.

644,639. Electric-Railway Signal. J. Shoecraft, Topeka, Kan.

644,646. Insulator for Use on Electric Railways. J. Thomas and W. R. Thomas, Catasauqua, Pa.

644,647. Selective Signal for Telephone Circuits. G. K. Thompson, Malden, and E. C. Robes, Medford, Mass.

644,652. Telephone Transmitter. J. M. Wilderman and E. A. Nelson, St. Charles, Mo.

644,653. Coin-Actuated Mechanism for Telephones. A. F. Wines, Chicago, Ill.

644,658. Cigar Lighter. C. B. Abbott and S. Abbott, Cleveland, O.

644,666. Controller for Electric Motors. M. W. Day, Schenectady, N. Y.

644,671. Electric-Motor Car. C. M. Johnson, New York, N. Y.

644,677. Machine for Preparing Continuous Rolls of Tobacco Wrappers for Manufacturing Cigars or Cigarettes. L. L. Maxfield and W. Maxfield, New York, N. Y.

644,680. Telephone Guard. L. B. Ordway, San Francisco, Cal.

644,683. System of Ignition. W. H. Pumphrey, New York, N. Y.

644,684. Dynamo-Electric Machine. H. G. Reist, Schenectady, N. Y.

644,714. Telegraph Sounder. S. F. Lively, Alderson, W. Va.

644,716. Electric Car Brake. U. E. Maille, Providence, R. I.

644,745. Electric Switch. N. Marshall, Newton, Mass.

644,779. Process of Manufacturing Metallic Carbonates by Electrolysis. J. W. Richards and C. W. Roepper, Bethlehem, Pa.

644,783. Electric Glow Lamp. J. Van Vleck, New York, N. Y.

644,784. Electric Glow Lamp. J. Van Vleck and W. N. Stevens, New York, N. Y.

644,785. Electric Glow Lamp. J. Van Vleck, New York, N. Y.

644,790. Railway-Signaling System and Apparatus Therefor. H. Bezer, New Rochelle, N. Y.

644,794. Tool for Laying Conduits for Electrical Conductors. J. F. Cummings, Detroit, Mich.

644,816. Electric Arc Lamp. W. J. Davy, London, England.

644,823. Electric Lamp for Bicycles. G. Heidel, St. Louis, Mo.

644,844. Electric Switchboard. M. T. Bunnell, New York, N. Y.

644,850. Fuse Block. H. P. Davis, Pittsburgh, Pa.

644,852. Electric Pump. C. Eickemeyer, Yonkers, N. Y.

644,858. Means for Giving Rigidity to Elbows or Turns of Flexible Conduit. E. T. Greenfield, New York, N. Y.

644,859 and 644,917. Electrical Measuring Instrument. A. H. Hoyt, Penacook, N. H.

644,860. Electric Gas Lighter. C. Hubert, New York, N. Y.

644,864. Electromotive-Force Regulation. B. G. Lamme, Pittsburgh, Pa.

644,865. System of Electrical Distribution. B. G. Lamme, Pittsburgh, Pa.

644,868. Telephone Signal Circuit. D. McNeil, Chadron, Neb.

644,878. Automatic Circuit Breaker. D. W. Stinson, St. Louis, Mo.

644,896. Explosive Shell. J. J. Coneys, Philadelphia, Pa.

644,962. Electric Arc Lamp. E. M Barnes, Cleveland, O.

644,972. Induction Coil for X-Ray Apparatus. R. A. Fessenden, Allegheny, Pa.

644,995. Vacuum-Tube Lighting. D. M. Moore, Newark, N. J.

645,007. Protective System and Apparatus for High-Tension Electric Currents. L. C. Reed, New Orleans, La.

645,008. Protective System of Electric Distribution. L. C. Reed, New Orleans, La.

645,009. System of Electrical Distribution. L. C. Reed, New Orleans, La.

645,010. Electric Circuit Breaker. L. C. Reed, New Orleans, La.

645,011. Underground System of Electrical Distribution. W. B. Reed and L. C. Reed, New Orleans, La.

645,012. System of Overhead Electrical Distribution. W. B. Reed and L. C. Reed, New Orleans, La.

645,013. Series-Arc System of Electrical Distribution. W. B. Reed and L. C. Reed, New Orleans, La.

645,014. System of Electrical Distribution. W. B. Reed and L. C. Reed, New Orleans, La.

645,015. Electric Railway. W. B. Reed and L. C. Reed, New Orleans, La.

645,021. Underground Electric Railway. G. W. Smith, Dallas, Tex.

645,041. Vacuum-Tube Lighting. D. M. Moore, Newark, N. J.

DESIGNS.

32,325. Field Ring or Frame for Electric Motors. C. A. Lindstrom, Chicago, Ill.

32,326. Automobile Electric-Motor Case. C. A. Lindstrom, Chicago, Ill.